The Tool Engineer

XTRUDING SOFT METALS . . . . PAGE 53

UBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

M Y, 1951
VO E XXVI, NO. 5

PLANNING
ENGINEERING OF TOOLING
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VOLUME XX
NUMBER 5
MAY, 1951

The Tool Engineer

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AMERICAN SOCIETY OF TOOL ENGINEERS

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second-class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, $3.00. Non-members, $6.00. Canada, $6.50; all other countries, $8.00 per year.
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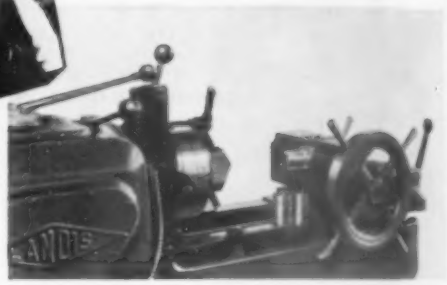

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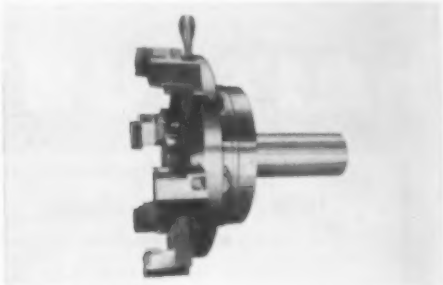

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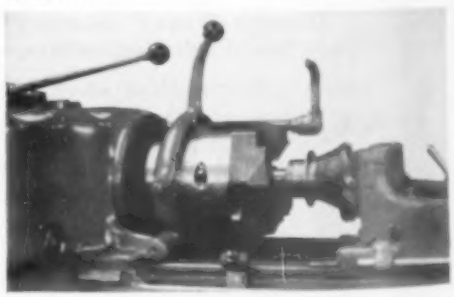

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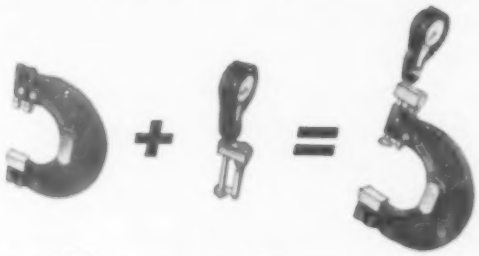

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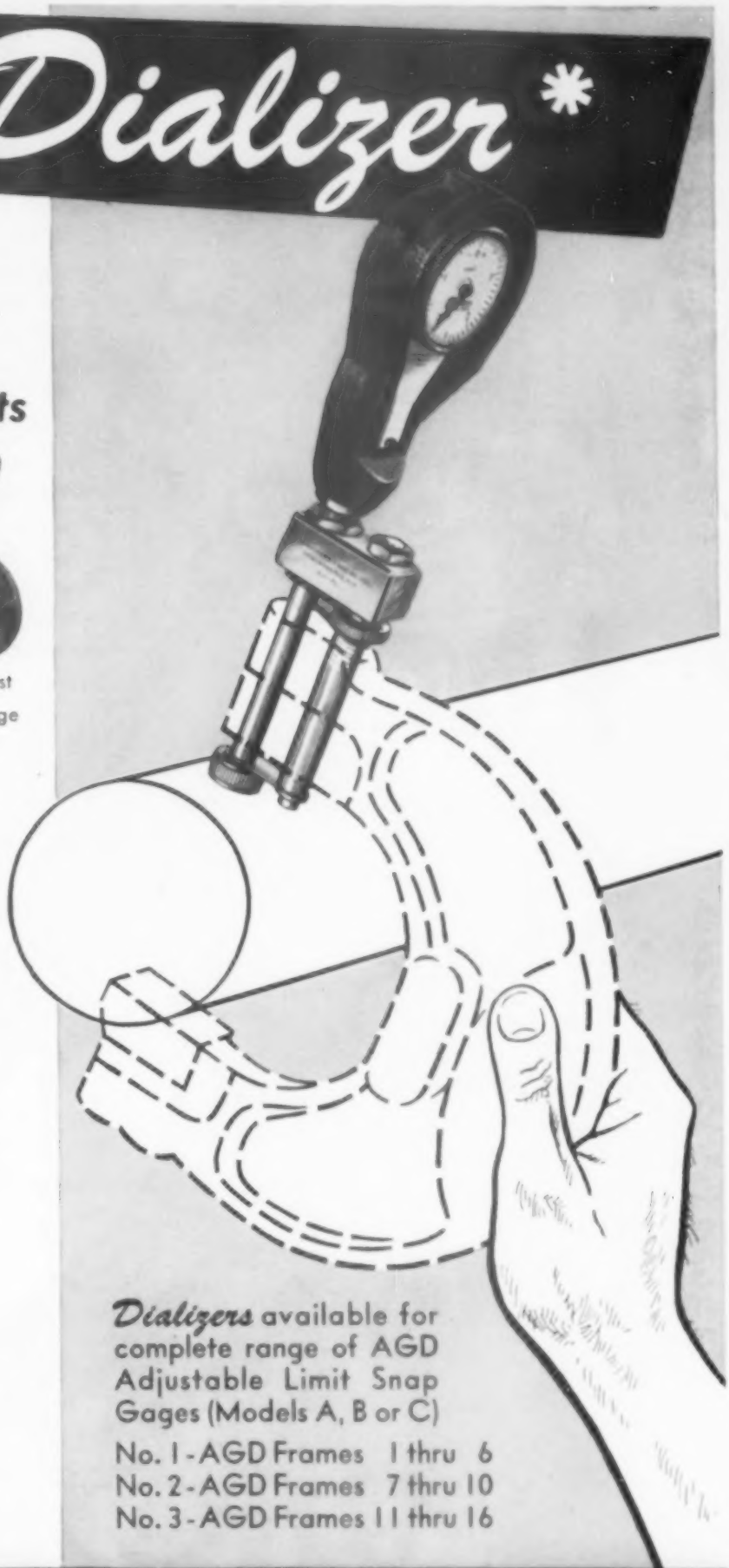

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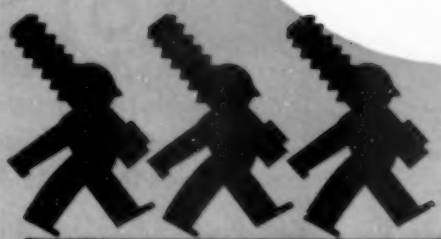

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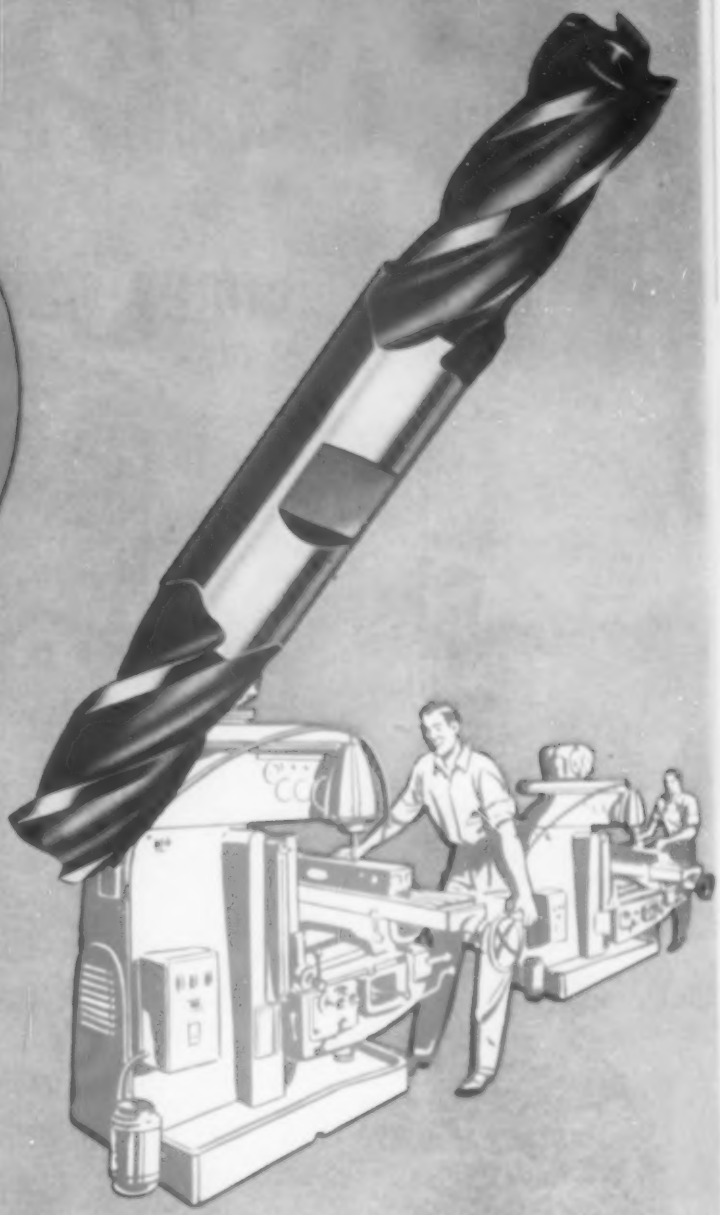

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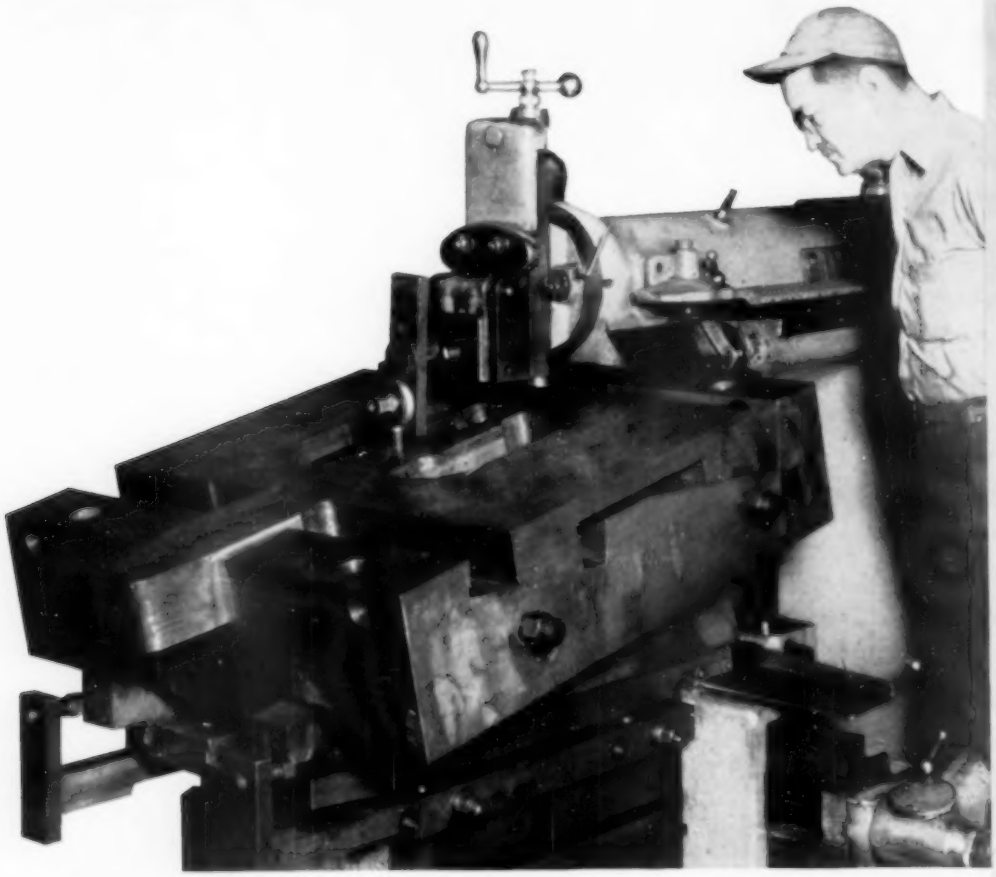

Eight to ten hours' work cut to fifteen minutes in this unusual application of a versatile Cincinnati Shaper.

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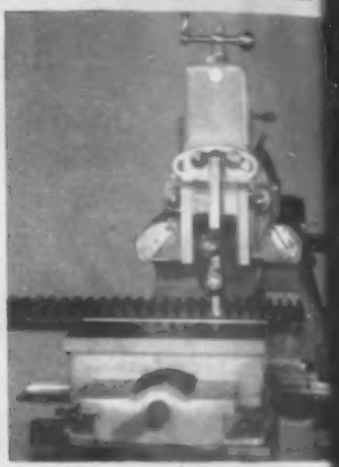

2. Maintenance and Repair
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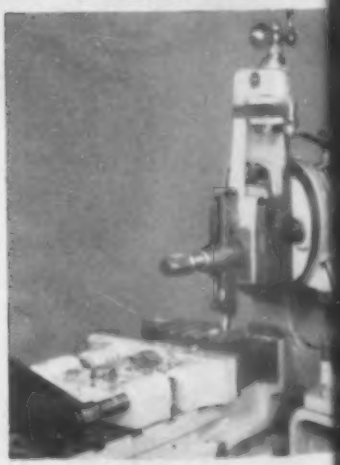
is invaluable for this work.



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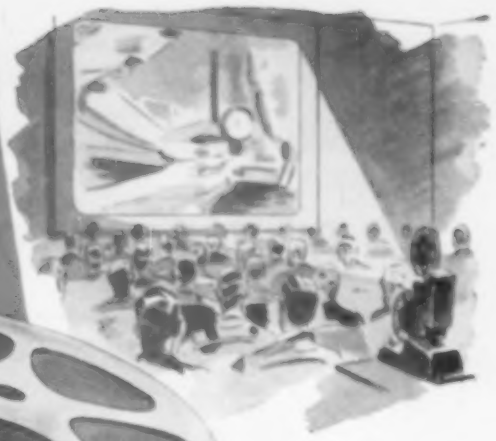

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. . . in two complete size and pressure ranges to simplify die design.

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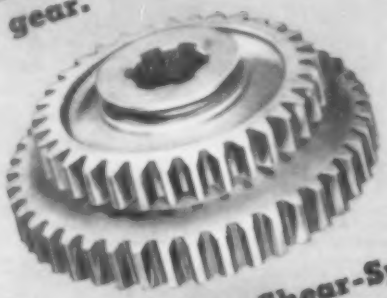
Example: A 33-tooth 7-pitch gear, 22½° pressure angle; ⅞ inch face width—a run-of-the-mine kind of gear.



Production: One Shear-Speed with one operator turns out in 6½ hours the required production which formerly took 8 hours on 14 conventional machines.

14
x 8
112
−6½
105½ hrs saved per shift!

THE KIND OF GEAR-CUTTING YOUR TOP MANAGEMENT "WILL GO FOR", TOO . . .

Any time you can up productivity per machine hour and man-hour *that* much, top management *is* interested.

The reason you can do this with a Shear-Speed is that it cuts all the teeth at once. The Shear-Speed doesn't care how many teeth there are or how big the gear is. Pitch and face width—total metal removal—are the only things affecting cutting time.

It's something worth talking to the big boss about. But before you do, get all the facts.

Fill in the coupon below and we'll see that you get them.

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Title _____

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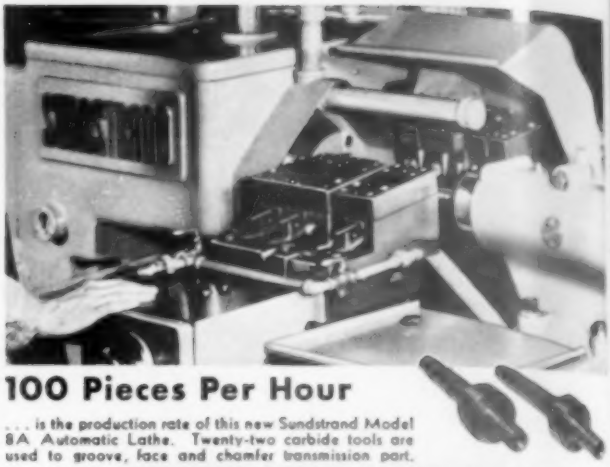
INCREASE YOUR PRODUCTION WITH THESE NEW SUNDSTRAND AUTOMATIC LATHES

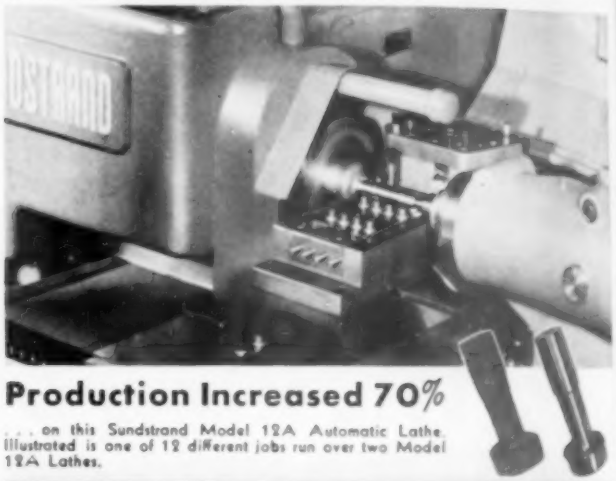
110 Pieces Per Hour

. . . are obtained on this Sundstrand Model 4A Automatic Lathe. Operations include turning, facing and forming.



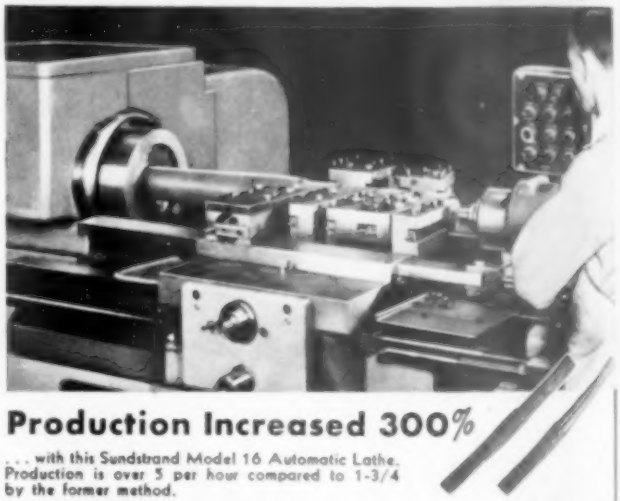
100 Pieces Per Hour

. . . is the production rate of this new Sundstrand Model 8A Automatic Lathe. Twenty-two carbide tools are used to groove, face and chamfer transmission part.



Production Increased 70%

. . . on this Sundstrand Model 12A Automatic Lathe. Illustrated is one of 12 different jobs run over two Model 12A Lathes.



Production Increased 300%

. . . with this Sundstrand Model 16 Automatic Lathe. Production is over 5 per hour compared to 1-3/4 by the former method.

These are only four of the 8000 or more users of Sundstrand Automatic Lathes. These users have always found Sundstrands a profitable investment and many have changed from old to new Sundstrand Automatic Lathes in order to get even higher productivity as a result of design improvements. The following features incorporated in the design of the latest models of Sundstrand Automatic Lathes will help you increase production.

Get Greater Horsepower

All new Sundstrand Automatic Lathes have been redesigned for greater rigidity and larger spindle drive motors. They have ample power for use of carbide cutting tools and are capable of doing more work. Note the massive headstock design in the machines illustrated.

Get a Wider Feed Range

A wider feed range has been provided to enable the handling of a greater range of parts and materials at maximum cutting efficiency. The New Models 4A, 8A, and 12A have a ratio of 18 to 1 between high and low feeds — Model 16 has an even greater range.

Get Greater Carriage Adjustment

Both front and rear carriage of the latest Sundstrand Automatic Lathes are adjustable full length between headstock and tailstock centers — another important new feature.

SUNDSTRAND

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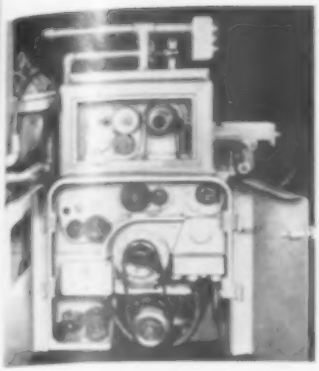

Get Faster Set-Up

The photo at the left is an end view of machine showing convenient location of pick-off gears for changing spindle speeds and front and rear carriage feeds. The feed and speed chart and pick-off gear storage compartment are readily accessible for quick set-up or changeover.

Get Quick Cycle Change-Over

Complete control of all cycles is provided by adjustment of dogs on a disk. Making cams is eliminated. Changing position of dogs on disk changes length of rapid approach, feed and rapid return strokes — enables operator to set up cycle quickly and change over from one job to another easily.

Get a Wider Speed Range

Spindle speed range ratios have been increased to 30 to 1 on all new Model Sundstrand Automatic Lathes to obtain maximum in cutting efficiency over a wider range of sizes of parts and material. The spindle unit is equipped with two driving gear centers, which increase the range between high and low spindle speeds. In addition, four speed changes can be obtained from one set of gears instead of the usual two.

Get Automatic DeClutching

All new Sundstrand models have been provided with automatic declutching between spindle and spindle motor with self-adjusting magnetic clutch and brake for quick stopping of spindle rotation.

Get Screw Feed to Front Carriage

All new Sundstrand Automatic Lathes have screw instead of rack feed to the front carriage — resulting in fine finish and long tool life.

Get Automatic Lubrication

To insure long machine life and lower maintenance costs, all moving parts within the machine such as spindle bearings, gears, carriage and cross slide ways are provided with automatic lubrication.

Get Hardened and Ground Steel Carriage Ways

All new Model Sundstrand Automatic Lathes have hardened and ground carriage and cross slide ways.

4 Models Cover HP Range of 3 to 75 HP

	MODEL 4A	MODEL 8A	MODEL 12A	MODEL 16
SPINDLE MOTOR	3 to 10 HP	10 to 25 HP	20 to 50 HP	50 to 75 HP
SPEED RANGE (Type A) (Type B)	60 to 1800 RPM 120 to 3600 RPM	40 to 1200 RPM 80 to 2400 RPM	30 to 900 RPM 60 to 1800 RPM	15 to 750 RPM
FEED RANGE	.003 to .048 IPR.	.004 to .070 IPR	.004 to .070 IPR	.0025 to .100 IPR
FRONT CARRIAGE: Longitudinal feed with angular feed-in, max. Swing over cross slide, max. Rapid traverse rate	 5" 8¾" 275"	 6" 12½" 250"	 8" 15¼" 250"	 12" 17" 250"
REAR SLIDE: Max. Stroke	4"	5½"	6½"	8"
LENGTH BETWEEN CENTERS	15, 24 & 36"	24, 36, 48 & 60".	24, 36, 48 & 60"	36, 60 & 84"

FREE ADDITIONAL DATA

The complete new line of Sundstrand Automatic Lathes includes the Models 4A, 8A, 12A and 16 and they range from 3 to 75 HP. Write for complete information on these new machines today. Ask for bulletin 707

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Call the nearest scrap dealer; ask him to give you a price. He'll pay good money for it. Prices are high . . . the nation's steel plants need scrap badly. With a stepped-up defense program under way, scrap is more than ever a vital ingredient of steel production. Industry must help take up the slack—*fast*.

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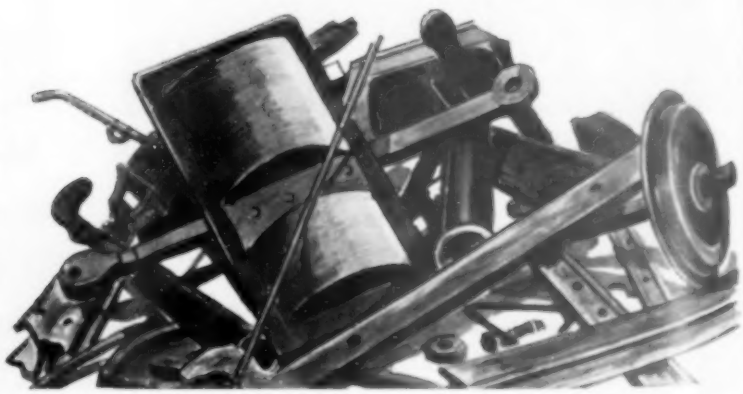

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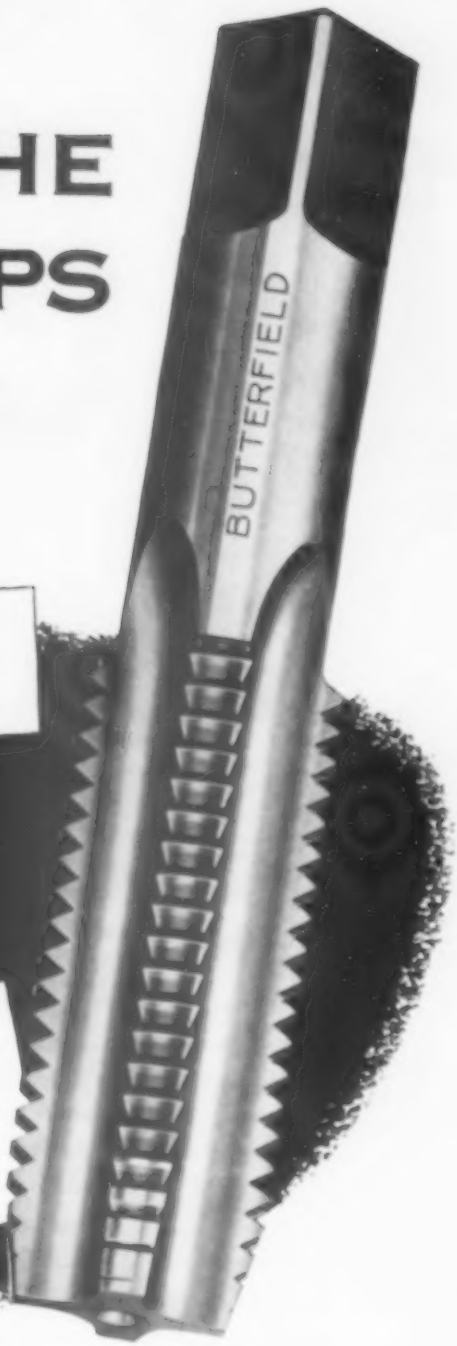

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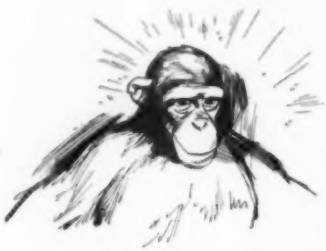

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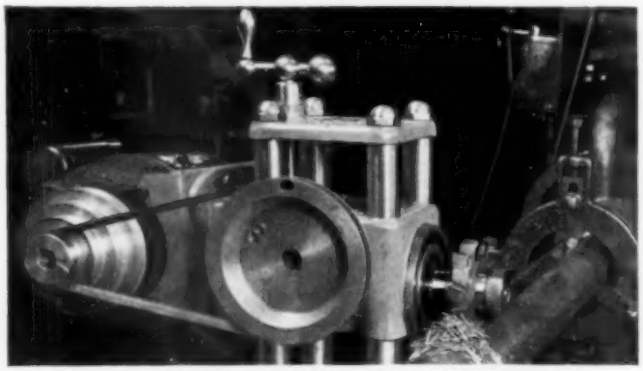

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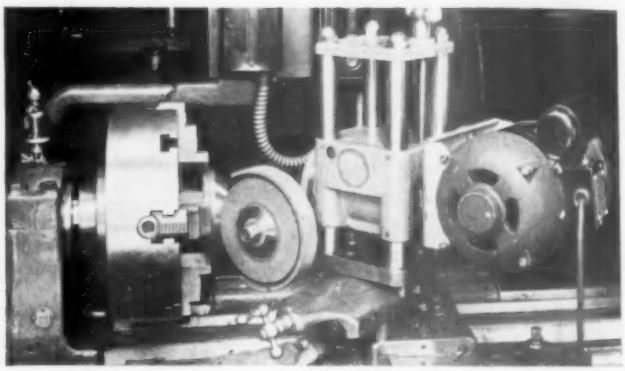

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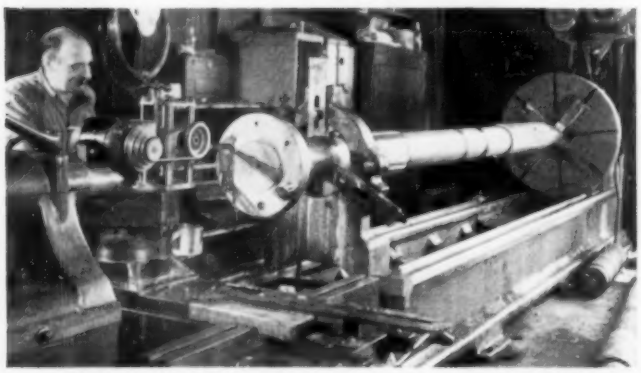
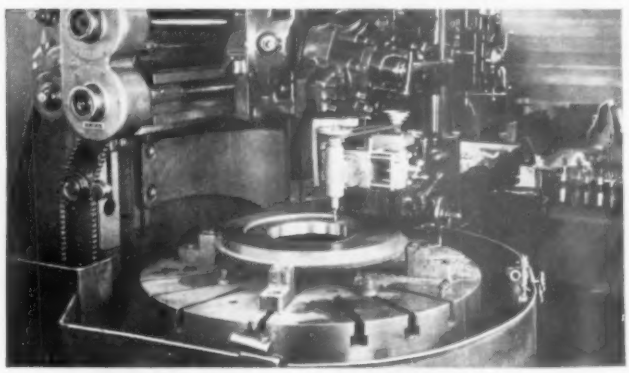


DRILLING 1-3/4" HOLE in forged steel. Final operation: Hole bored 2" ±.001". Aircraft-type worm and gear transmits power and develops torque required for this job at 1" per minute feed.



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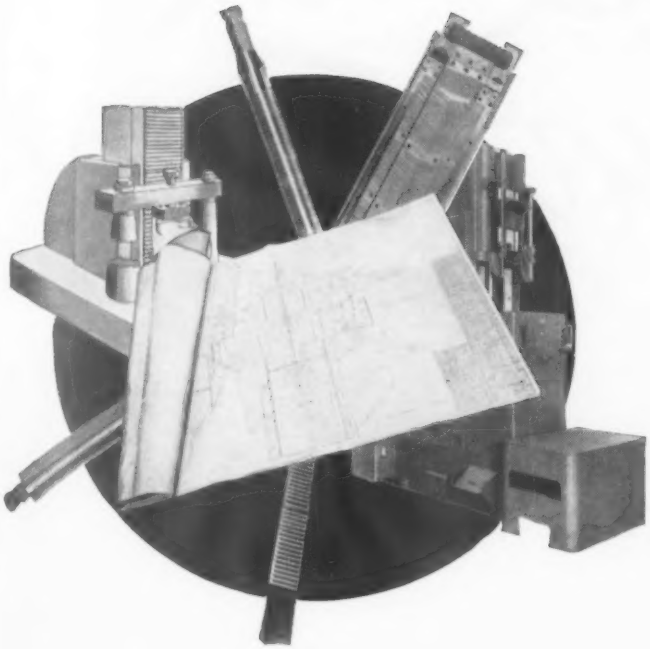

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THE TOOL ENGINEER
Publication of The American Society of Tool Engineers

The Tool Engineer

a Letter from the Editor...

As was the case last year, *The Tool Engineer* again brings you a selection of technical papers from this year's Nineteenth Annual Meeting of ASTE. A majority of the papers presented at New York have been or will be published in *The Tool Engineer*, along with our regular tool engineering features—with each issue balanced editorially to provide concrete help to the greatest possible number of readers.

We've had a number of interesting comments on this handling of national papers, and the subject is of enough importance to every reader that I'd like to briefly run through the background and ask you to write to me explaining your feelings.

Excluding national papers, *The Tool Engineer* is made up of contributed material, articles which are staff-written and material arranged for on an exclusive basis. Each issue is set up individually so that it is balanced so far as type of material and article length are concerned.

Some readers have asked for a larger number of national papers in *The Tool Engineer;* others would prefer to have national papers available in a separate bound volume. The bound volume would, of course, have to be financed either through a nominal price per copy or through a proportionate increase in registration fees at national meetings.

There has also been some interest in publishing the prepared and floor discussions accompanying the presentation of our national papers. I'd like your reaction to that proposal—realizing that presentation of these valuable comments would tend to reduce the total number of articles per issue.

These are some of the suggestions that have come across the editor's desk. It would be a great help to me to have your personal reaction.

Gilbert P. Muir

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The Tool Engineer

Editorial

TOOL ENGINEERS in many industries which are converting part of their capacity to defense production are facing a problem that will become even more important during the next couple of years.

In consumer production, the application of tool engineering principles assumes that, for the most part, a completed product design is final so far as major design changes are concerned. Therefore, all planning and tooling are done with that in mind, including the very nature of the tooling, which depends largely on the complexity of the part and the anticipated volume required.

Military production has its inherent characteristics, and one of these is that the proving ground for the product must often be the battlefront. Components or design features which appear satisfactory in the design room are not practical in the field, and demands from the field for changes filter back frequently.

As the services modify their designs, the manufacturer must incorporate these changes immediately into his current production, and here the tool engineer faces the problem that basically opposes many of the operating principles of his profession.

There is no ready answer to this. Tank designs cannot be frozen to suit the tooling plans of the producer. Neither can the tool engineer rely on inadequate tooling in anticipation of future design changes. But there are two partial solutions which, if developed to the fullest extent, can provide a workable way to reduce this necessary confusion. One is a greater supply of better-trained tool engineers, and the other is a continuous refresher course to keep tool engineers at their top operating efficiency. The first is up to industry and our universities; the second is a prime function of ASTE with the cooperation of industry and government.

J. J. Demuth

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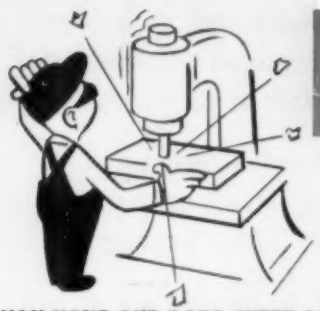

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LATROBE ELECTRIC STEEL COMPANY
LATROBE, PENNSYLVANIA

Selecting and Processing Steels for Lamination Dies

By Lester F. Spencer

CHIEF METALLURGIST
LANDERS FRARY & CLARK

Part I

OF THE GRADES OF ELECTRICAL steel sheets available, varying from 0.25 to 4.5 percent silicon, there is a specification which will meet practically every electrical equipment requirement. As the silicon content rises with progressive grades of electrical steel sheet, the guaranteed maximum core losses decrease in value for a given sheet thickness. The sheets in general become stiffer, or harder; the Rockwell values gradually increase and the Erichsen ductility values decrease for the same gage and sheet finish. Some of the guaranteed grades of silicon sheet stock include:

(1) Armature grade contains 0.5 percent silicon; it is a soft sheet with good punching qualities. Thickness usually runs from 16 to 26 gauge. The Rockwell 'B' hardness of the "as received" sheet is usually 38 with an Erichsen cup value of 8 mm.

(2) Electrical grade contains about one percent silicon, and also has good punching qualities. The thickness of sheets usually range from 16 to 29 gage with the majority of the sheets lighter than 22 gage. The Rockwell 'B' hardness of the "as received" sheet is approximately 50 with an Erichsen cup value of 7.8 mm.

(3) Motor grade contains approximately 2.5 percent silicon. The sheet is stiffer than the previously mentioned grades, however, it still has fairly good punching properties. The usual gages are from 22 to 29, a Rockwell "B" 73 hardness can be expected in the "as received" material, with an Erichsen cup value of 6.5 mm.

(4) Dynamo grade contains approximately 3.25 percent silicon, producing a stiffer and harder sheet than those previously mentioned. This grade has fairly good punching properties. The thicknesses usually range from 24 to 29 gage, and a Rockwell hardness of B75 can be expected, with an Erichsen cup value of 5.5 mm.

(5) There are several grades of transformer steels: the higher silicon grades of 4 to 4.5 percent are usually quite brittle and may give difficulty in stamping. The Rockwell hardness of these materials usually ranges from B83 to B87 with Erichsen cup value between 3.5 and 4.3 mm.

Strain Problems

The punching operation generally produces greater straining and penetration of straining along the cut edges of laminations as thickness of the sheet increases. This straining of the material increases the core losses and reduces the permeability. Thus, it is desirable to anneal 24 gage laminations, especially those of the smaller sizes. The same degree of improvement is not obtained from annealing of the thinner gages, however, both the 26 and 29 gage materials are annealed when they are to be used in high-efficiency rotating machines and transformers in order to realize all improvement possible. The general annealing requirements of all grades of silicon steel laminations[2]* include:

(1) Bring the charge to the range of 1350-1450 deg F and hold for about one hour, then slowly cool to about 400 deg F in not less than 10 hours.

(2) Keep the charge sand sealed so that the laminations are annealed in their own atmosphere.

Laminations within a charge should be stacked closely and the cover should fit snug, to reduce the ratio of enclosed volume to iron volume. Allow the cover to remain undisturbed until the charge reaches 400 deg F after annealing. Then the cver can be removed to accellerate cooling to room temperature. The suggested practice of annealing[2] not only returns original properties by relieving the strained conditions, but often results in improvement through coreloss and permeability.

*Numbers indicate references which will be listed at close of Part II of this article.

Table I Die clearances (for small lamination dies) (7)

Grade	#29 gage	#26 gage	#24 gage	#22 gage
Transformer	0.0007 in.	0.00085 in.	0.001 in	———
Dynamo	0.0007 in.	0.00085 in.	0.001 in	———
Motor	0.0006 in.	0.00075 in.	0.0009 in.	———
Electrical	0.0005 in.	0.00075 in.	0.0009 in.	0.0015 in.
Armature	0.0005 in.	0.00065 in.	0.0008 in.	0.0015 in.

° — Location of Rockwell tests

+ — Location of Brinell tests

(Sketch to show location of hardness tests on 4 inch cube. Values enumerated in accompanying table.)

Nominal Composition of Steels Tested

Elements	Steel 'A'	Steel 'B'
Carbon	1.55%	2.20%
Silicon	0.38	0.30
Manganese	0.25	0.20
Chromium	12.00	12.00
Vanadium	0.80	0.80
Cobalt	0.40	0.50
Molybdenum	0.80	———

Proper annealing after punching usually adds a tight thin bluish oxide to all surfaces of the lamination; this oxide has a high electrical resistance and serves to increase the interlamination resistance (important in reducing interlamination losses). Core plating increases interlamination resistance over that obtained by surface oxide coating.

In the stamping operation of this specific material, this property varies with the silicon content of the material selected. Thus, the higher transformer grades containing from 4 to 4.5 percent silicon are quite brittle; this characteristic giving quite a bit of difficulty in stamping operations. This can be readily overcome by proper sharpening of well constructed stamping dies[7], in which accurate die clearances are maintained. Softer steels of lower silicon content and lighter gages of all grades require close fitting dies[7], whereas the more brittle steels and heavier gages require greater clearances between the die and the punch. Uniform die clearance is essential around the entire cutting contour of each punch.

It is essential that sturdy, accurate dies be employed in the stamping of silicon sheet with uniform clearances approximating that given in Table I. In this table, the die clearances given are general since both the size and the shape of the parts punched will modify the practice. Die parts should be tapered[7] from 0.0015 to 0.0025 inches on each side of the die, for 1.25 inch of depth to give the required die "relief". This results in an increase of 0.001 to 0.002 inches per side of each punch when the die has been worn down to one inch. It is also recommended[7] that for lowest die cost per pound of finished laminations, burr inspection limits should be maintained as a basis of good die grinding practice. The following burr limits can be followed:

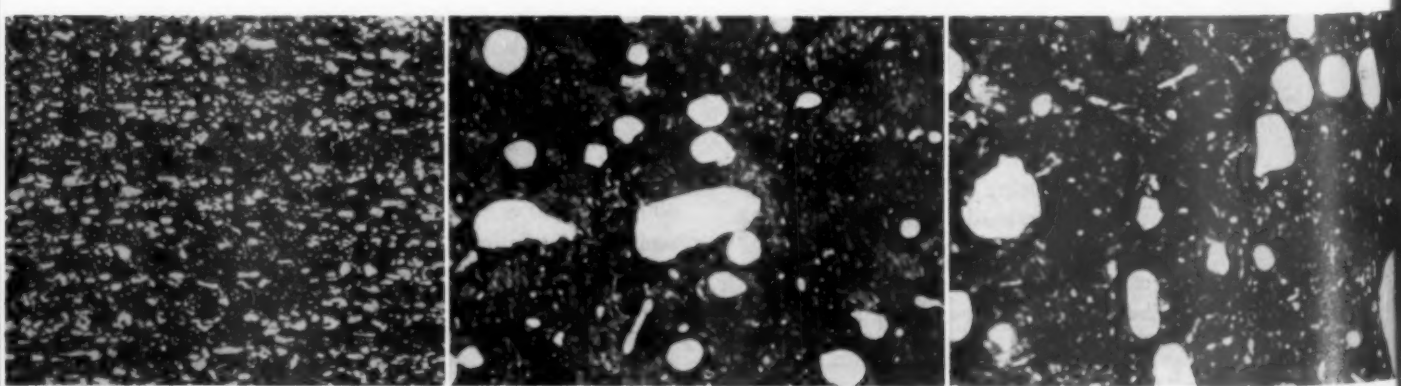
Gage	Burr Limit	Gage	Burr Limit
#29	0.002 inches	#26	0.0025 inches
#24	0.0030 inches	#22	0.0035 inches

This procedure will result in less die steel removal per grind and the increased die life, while producing high-quality magnetic core laminations.

Silicon lamination material is available in both sheet form and in coils; the latter having a definite advantage when it is being fed into high-speed automatic presses. Sheet and coiled stock of the same analysis have different magnetic and physical characteristics. Thus, according to Shingledecker[5] "In general, coiled stock has superior qualities to sheets when the path of magnetic flux in the finished transformer lamination is in the direction of rolling, and poorer characteristics from sheet when the path of magnetic flux is across the direction of rolling, that is, across the strip. This makes coiled stock ideal for wound cores but it is at a disadvantage in transformer laminations where a large part of the flux path is across the direction of rolling. On the other hand, laminations made from coiled stock have a better stacking factor."

Other factors are minimum scrap loss, dimensional accuracy and long die life. Die life and maintenance of components during service life are of extreme importance due to high initial cost, and become more critical as silicon content of the material increases, since higher silicon steels produce greater die wear.

Photomicrographs below indicate (left) general structure of composition 'A' air quenched, x150; composition 'A' air quenched and tempered, carbides in matrix of tempered martensite, x1500, shown at center; structure of composition 'A', at right, oil quenched and tempered; carbides in matrix of tempered martensite, x1500.



The high carbon-high chromium type tool steels are generally accepted as the more suitable to withstand the abrasive action of silicon lamination stock. Their better service is attributed to the numerous and extremely hard chromium carbides that are dispersed within the matrix; this combined with the remarkable non-deforming properties of these steels make them ideally suited for use as lamination die material. This group of steels can be divided into both oil and air hardening steels, or at times, divided into divisions on the basis of the carbon content. The original high carbon-high chromium type steel normally known as the 12-2 (12 chromium and 2 carbon) is considered as one group. The later modification, containing 1.5 percent carbon to obtain better machinability and less brittleness, can be considered as the second group.

Resistance To Wear

The wear resistance of the high carbon-high chromium tool steels is approximately eight times that of the carbon steels[1] provided that hard abrasive particles are not present. In regard to the effect of the additive elements that are usually associated within these compositions such as vanadium, tungsten, silicon or nickel, much work has been done, however, according to Gill[1] very little substantial proof has been given as to the direct effect of these additive elements. At heat treating temperatures, it has been stated[1] that those compositions with the lower carbon content (1.0/1.5 percent) have a much higher chromium content dissolved in austenite while the dissolved carbon is slightly reduced. Thus, the austenite in those steels will be more stable both in quenching and upon tempering, but it is likely that less retained austenite will exist upon quenching. Since a considerable percentage of chromium must re-dissolve at the heat treating temperatures, more soaking time should be allowed than for the lower alloy steels, to attain maximum hardness.

The compositions indicated as types 1 and 2 in Table II are considered oil hardening analyses. With their higher carbon content, these steels have the highest initial "as quenched" hardness of any within the classification. The increase in carbon has a definite effect on toughness, however, this is relieved to some degree by decreased depth of hardenability[6], superior abrasion resistance and mimimum distortion upon heat treatment. This composition deforms slightly more than the air-hardening analysis (type 3) and also is a bit harder to machine.

Table II - Typical Compositions of High Carbon - High Chromium Die Steels and their basic Characteristics

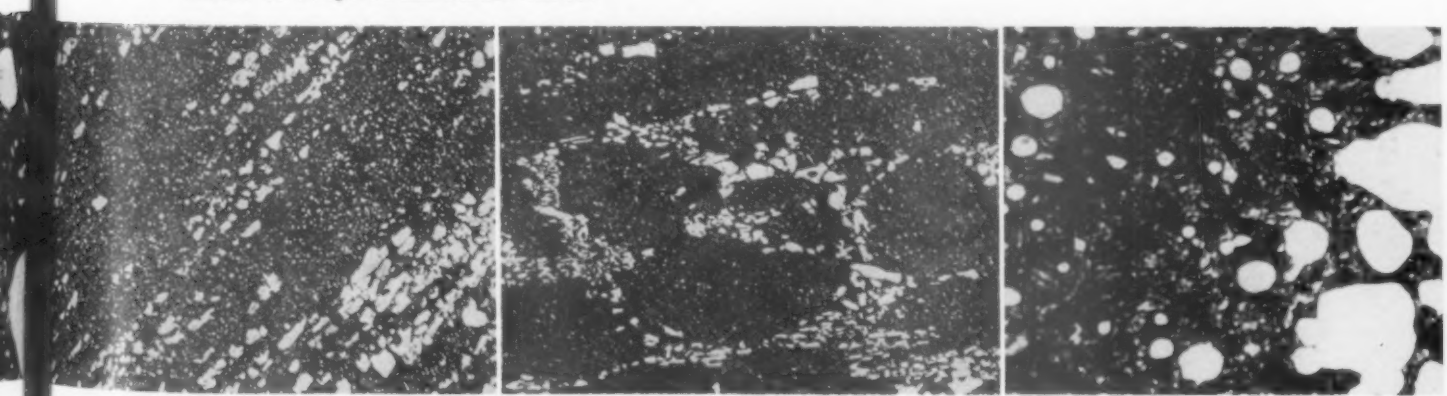
	Chemical Composition				Per Cent	
Type	C	Mn	Cr	V	Mo	Co
1	2.00	0.30	12.00	0.25	—	—
2	2.25	0.30	12.00	0.25	0.80	—
3	1.50	0.30	12.00	0.25	0.80	—
4	1.35	0.30	12.75	—	0.80	3.00

Characteristics		
2.0 Carbon	12 Chrome, 1½ Carbon with Molybdenum	Cobalt High Carbon
1. High hardening temperature.	1. High hardening temperature.	1. High hardening temperature.
2. Little danger of cracking.	2. Negligible cracking hazard.	2. Negligible cracking hazard.
3. Low distortion.	3. Deep hardening.	3. Deep hardening.
4. Difficult to machine and grind.	4. Low toughness.	4. Low toughness.
5. Deep hardness.	5. High costs.	5. High costs.
6. Low toughness	6. Low distortion.	6. Low distortion.
7. High cost.	7. Difficult to machine and grind.	7. Difficult to machine and grind.
8. Superlative wear resistance and compressive strength.	8. Good wear and abrasive resistance.	8. Good abrasion resistance.
		9. High edge strength.
		10. Response to nitriding.

Referring again to Table II, type 3 can be classified as an air-hardening steel, however, this composition can also be oil hardened. Air quenching is used considerably where dies of intricate sections are involved. This steel has better machining properties than the above two compositions.

The high carbon-high chromium type containing cobalt (type 4, Table II) is considered an air hardening type utilized for intricately-shaped dies where its superior abrasion resistance and ability to hold a keen cutting edge[3] are desired. The addition of cobalt is reputed[3] to increase its secondary or red hardness and impart greater edge strength.

General structure of composition 'B' (left), oil quenched and tempered—massive carbides with tendency toward bending, x150; center, another section of same specimen—carbide envelope structure, x150; at right, structure of composition 'B', air quenched and tempered—massive carbides and segregation in matrix of tempered martensite x1500.



Production Plunge-Cut Grinding

By Frank W. Curtis

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MACHINE TOOL DIVISION
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PLUNGE-CUT GRINDING is done by feeding an abrasive wheel directly into a cylindrical part, so that the entire width of the area or areas to be ground are finished simultaneously, without the necessity of longitudinal table traverse. An outstanding advantage of the process is the speed with which journals or bearing surfaces can be finish ground to close tolerances. The limitations lie in the overall proportions of the workpiece, usually in the length of the journal, or in the spacing between the surfaces to be ground.

Much progress has been made during the past few years both in the grinding-machine equipment and in the abrasive wheels used for plunge-cut grinding, enabling the use of this grinding technique to be expanded considerably. In many cases two or more grinding operations can be combined into one by the use of (1) formed wheels to grind several diameters, (2) spaced wheels for finishing faces, journals or formed surfaces simultaneously, or (3) by applying multiple wheelhead grinding machines.

One of the most common uses of plunge-cut grinding is for the finishing of single journals, as shown in the upper left, Fig. 1. The workpiece is made with a recess at the shoulder so that the wheel grinds only the diameter of the part. Stepped surfaces also can be plunge ground (top center, Fig. 1) with the wheel feeding in at right angles to the centerline of work, providing the step is not too pronounced, as might be determined by the limitations of the wheel dressing or truing device. The use of spaced wheels for grinding two or more diameters is another broad use for plunge grinding, as shown in the example in the upper right. Such surfaces can vary in diameter and can be either straight, tapered or formed.

When a face or shoulder is to be ground simultaneously with a diameter, using a straight in-feed wheel, as at the lower left, the usual practice is to move the table longitudinally so that the side of the wheel contacts the face of the shoulder. Normally, table stops are used to facilitate table movement in both directions, which as a rule is accomplished after the wheel has reached size. A more practical way to grind a diameter and a shoulder together is by having the wheel head feed in at an angle rather than straight (lower center). Angular spaced wheels also can be used, as at the lower right, to grind more than one surface at a time.

Plunge Grinding Multiple Surfaces

A set-up for plunge grinding a straight and a tapered surface of a flanged part simultaneously, is illustrated in Fig. 2. A single wheel is used in this example, although two spaced wheels could be applied equally well. The choice between one or more wheels is determined usually by their cost. If the spacing between wheels is not too wide, one wheel may be more economical, but if a wide spacing exists then separate wheels would be preferable. The wheel in this case is 4-in. wide, and is dressed by means of a cam-controlled dressing device, mounted integrally with the wheel hood, and provided with hydraulic feed. The diameters of the ground surfaces are of approxi-

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

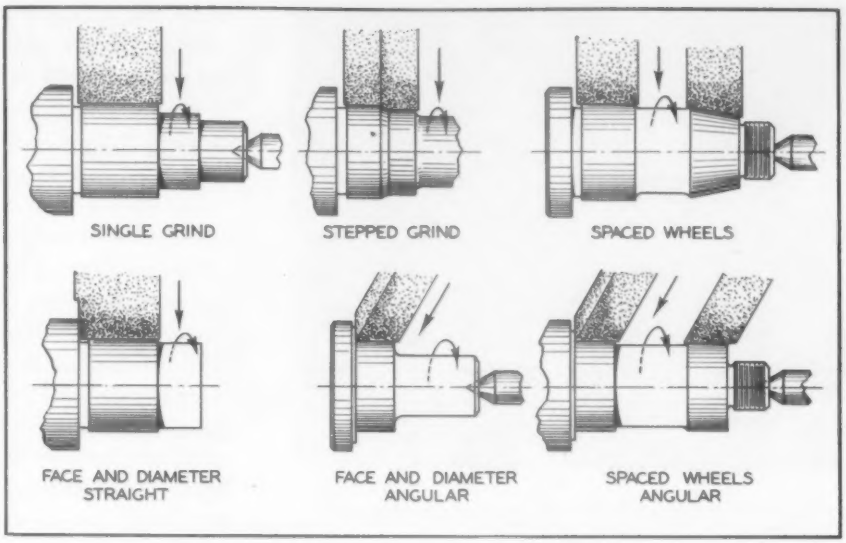


Fig. 1. Plunge-cut grinding can be arranged with either straight or angular in-feed wheels to finish single or multiple diameters.

mately 2-in. diameter: with a removal of 0.012 in., a part is finished in 15 seconds.

In plunge-cut grinding steel parts of this kind, ranging up to 4-in. diameter, the rate of stock removal is estimated usually at 0.001 in. per second. On parts of larger diameter, from 4 up to 6 or 7 in., the removal is figured at a rate of about 0.001 in. per revolution of work, while the surface speed of the part is from 60 to 75 fpm. Accuracy is essentially a function of grinding time, because where close limits are desired it is necessary to provide a longer spark-out time, adding from 5 to 20 percent to the normal grinding time.

Grinding Cylindrical Forms

Fig. 3 shows the grinding of two bearings of a rear-axle pinion shaft, using two 30-in. diameter spaced wheels with a straight in-feed plunge. Removing from 0.010 to 0.012 in. on each surface, the part is ground to a tolerance of 0.0002 in. in 20 seconds floor-to-floor time. The diameters are $1\frac{3}{4}$ and 2 in., and the lengths $1\frac{3}{8}$ and $1\frac{1}{2}$ in. Wheel dressing is done by a hydraulically-controlled hood-type dresser. The illustration shows a sizing gage, in contact with the smaller diameter, used as an auxiliary means of checking size while grinding.

As in all cylindrical grinding, it is advisable to keep the stock removal to a minimum, consistent with the shape and the size of the part. The amount of stock has a direct relation to output, or grinding time per piece. Moreover, the less the stock removal, the fewer will be the wheel dressings required and of course the lower will be the wheel cost per piece.

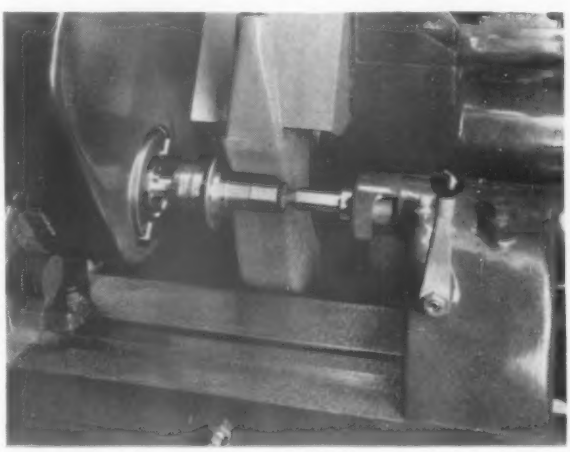
Angular Wheelheads for Grinding

For angular plunge-cut grinding, the wheel spindle may be set from 10 to 45 deg with the centerline of the work, depending on the ratio of the area of the face to the length of the diameter. Usually, the angle increases in proportion to any increase in the area of the face. There is an advantage in holding the face surface as narrow are consistent with its need. At the upper left, in Fig. 4, is a part having proportions which could be greatly improved if made as shown directly below with a step so as to reduce the area of face to be ground. By this change the ratio of wheel wear between the diameter and the side of the wheel becomes more or less proportional, so that the shape of the wheel remains the same during repeated dressings.

Wheel Angles and Speeds

If an excessive wheel angle is used with a wide abrasive wheel, as in the spaced-wheel application in the upper right, the differential in peripheral speed of the wheels becomes greater, so that one wheel may operate at correct speed and the other one somewhat less, because one wheel is smaller than the

Fig. 2. Plunge grinding a straight and tapered surface, using a single 4-in. wide wheel.



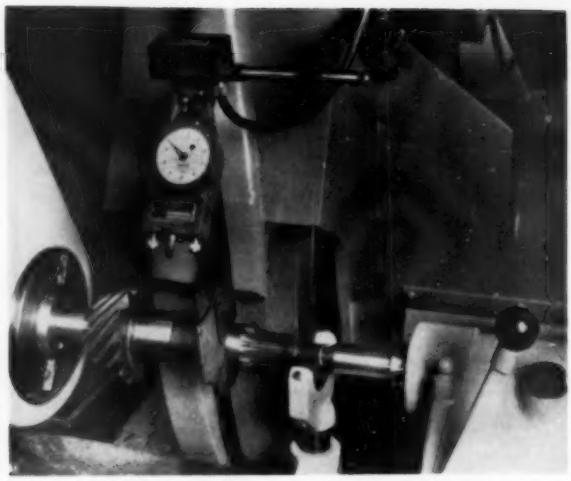


Fig. 3. Two spaced wheels used for plunge-cut grinding a rear-axle pinion shaft.

other. Some speed differential exists with all angular wheels, so that calculations for overall wheel life should be analysed to make sure the wheel speed will remain within safe operating limits. For example, using a 45 deg angle on these wheels, and having a 4-in. overall width, one wheel might be 28-in. and the other 25-in. diameter. The larger wheel will operate at 6600 fpm and the smaller one at 6000 fpm when new; but, when worn down to 24-in. and 21-in. respectively, the operating speeds will fall to about 5700 and 5100 fpm. This analysis would show that with the 45 deg feed-in angle the overall speed differential would be from 6600 to 5100 fpm. By using a 20 to 30 deg angle as shown in lower left, Fig. 4, the condition could be improved because the overall wheel speed differential is reduced.

Grinding With Multiple Wheels

Multiple-wheel plunge grinding can be performed with single- or double-spindle machines, of which the wheelheads for the latter can be spaced in tandem, or opposed, or at various angles to meet grinding needs. Fig. 5 illustrates a variety of typical multiple-wheel set-ups. The example at the upper left is a single-spindle machine with three spaced wheels for grinding shoulders of a transmission shaft. Special multiple preset diamond dressers are commonly used to true the wheels simultaneously and to maintain the relationship of the three wheel faces. For multiple diameters, as at the lower left, which also includes one shoulder, a double-spindle machine is used. One wheelhead grinds the stepped journal, and the other wheelhead, set on an angle, grinds the other journal and face. The faces of the flange and the diameters in the view at upper right are ground on a double-spindle machine, both wheel-heads being set angularly. The opposed wheels in the center example grind the faces of a shifter groove, while the set-up at the lower right combines two wheelheads for grinding various surfaces of the flanged end of an axle shaft.

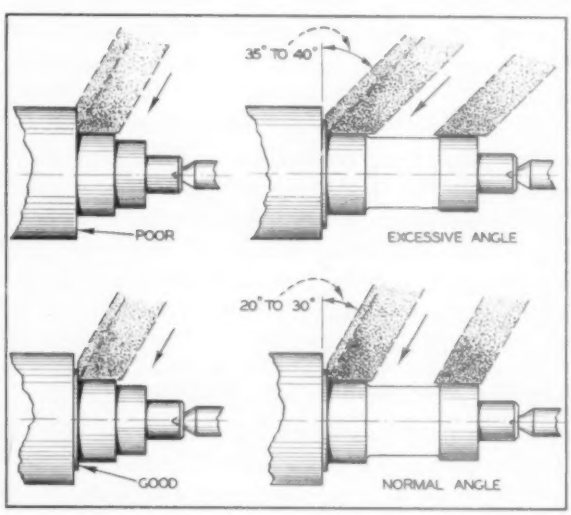
With a grinding machine of sufficient size, abrasive wheels up to 4-in. wide or slightly wider, can be used in plunge-cut grinding. Beyond this range, and due to the resultant overhang of the wheel center and wheel, table traverse with a narrower wheel becomes advisable. On some light work, and when the outboard bearings of the spindle can be extended under a recessed-type wheel center, wheels up to 10-in. width can be used. With the use of spaced wheels an overall width of 6 in. can be considered for normal work, and spacings of 12 in. for lighter work, as shown in the examples at the upper right. When wheel spacing becomes excessive, the overhang of the wheels will affect the accuracy, a double-wheelhead grinding machine should be considered.

Dressing and Truing Devices

Abrasive-wheel dressing and truing devices are made in a variety of styles to suit the wheel form required, but usually are either of the wheelhood- or table-mounted types. In Fig. 7 the upper examples represent hood-mounted dressers for straight, angular and formed wheel dressing. The path of the quill holding the diamond is controlled by a cam so that, as the slide moves back and forth, the quill follows the path of the cam whether it is straight or formed.

The cams can be made to operate with angular faces up to 38 degrees. Beyond this limit there would be undue strain on the follower, and a locking action is likely to occur. With more pronounced forms and angles, the dressing device can be made with two cams, one for each direction of the slide travel, and with a means for shifting the cam follower at each end of the slide stroke.

Fig. 4. Faces of flanged shoulders should be reduced in area where possible. Angle of approach for the wheel should not be excessive.



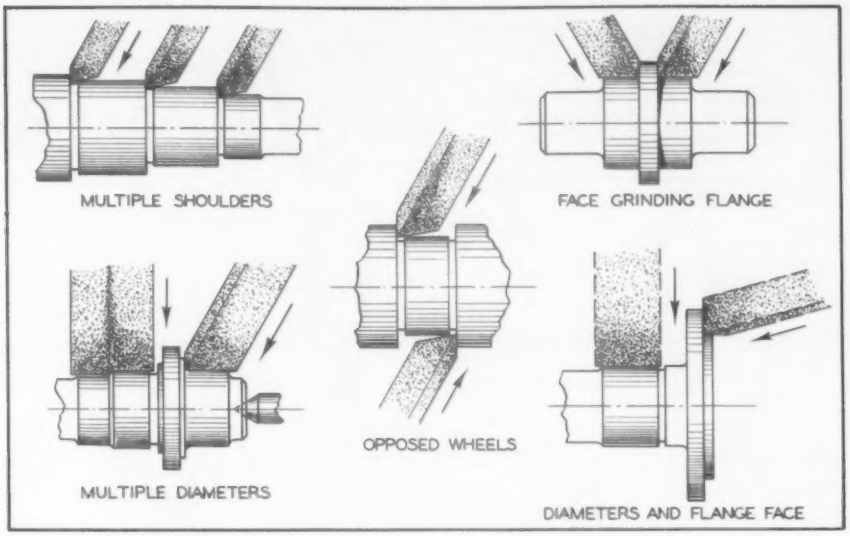


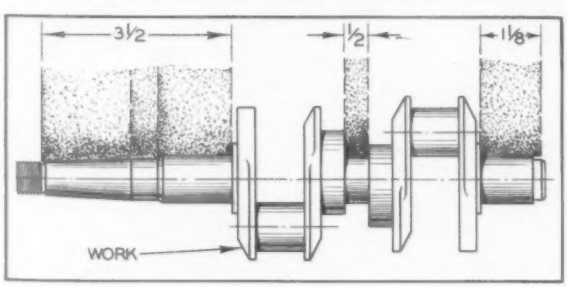
Fig. 5. Multiple wheels can be used with single or double spindle plunge-cut grinding machines, using tandem, opposed or angularly positioned wheelheads.

The lower examples in Fig. 6 show table-mounted dressers for straight, side and radius wheel truing. These devices are made usually with a hinged dressing arm which can be swung back to clear the work so that the dresser can remain on the table at all times. For the dressing of straight wide wheels, the table-mounted swing-type dresser, used in combination with table feed, has the advantage that size can be maintained without other compensations, once the diamond is set in relation to the diameter of the work. The procedure in dressing is to feed the wheel in to final size and then control the amount of wheel dressing by means of the handwheel that controls the in-feed of the wheelhead. With hood-type dressers, it is necessary to readjust the wheelhead inward an amount equal to the depth of wheel dressing.

Crush Dressing Formed Wheels

Crushroll dressing finds its broadest use in dressing irregularly-shaped wheels where cam-operation might become complicated or impossible. Crush dressing is, however, not too well suited for truing straight, flat surfaces. In principle, crush dressing is carried out by feeding a formed steel roll, preferably hardened, into an abrasive wheel which usually is power driven to rotate at a speed of from 200 to 300 fpm. An alternate method is to drive the crush roll which in turn rotates the wheel, although the power-driven abrasive wheel with the roll idling is preferred because transmission is more positive.

Fig. 6. Layout shows three spaced wheels for plunge grinding small crankshaft. Centralizing of work in relation to the wheel is essential.



In operation, the crusher roll is fed to the wheel, usually by hand adjustment, so that the roll just touches the wheel. The wheel spindle then is started, to run at slow speed, as a rule being driven by a gear motor through an overrunning clutch. At the same time the feed to the dressing device is started so the roll feeds to a predetermined depth, usually on the order of 0.003 to 0.006 in., depending on the contour of the wheel form. After depth is reached, the wheel makes three or four additional revolutions and then is stopped, and finally the roll is withdrawn. It is preferable not to withdraw the roll while the wheel is rotating, because such action often causes excess wear on the roll. Multiple timing controls are used generally to automatically operate the sequence of crush dressing.

Compounds For Dressings

A light oil compound, rather than emulsified compounds, should be used with crush dressing and grinding. The rolls used are commonly from 3 to 4-in. diam, and are provided with slots to insure a better crushing action. Rolls may average from 50 to 100 dressings before requiring regrinding. As a rule, 5 or 6 crushing rolls and one master roll are required for each set-up. The master roll can be used to dress the abrasive wheel so that it can, in turn, be used to regrind the worn crush rolls. For this operation, the worn rolls are mounted between centers and are rotated at a speed of 60 to 80 fpm, and are then ground by the plunge method.

Grinding Transmission Shaft

In Fig. 8 is shown a set-up for plunge-cut grinding a diameter and adjoining face of a transmission shaft, using a wheelhead set at an angle of 30 degrees. On the table may be seen a swing-type table-mounted dresser which is used for truing the

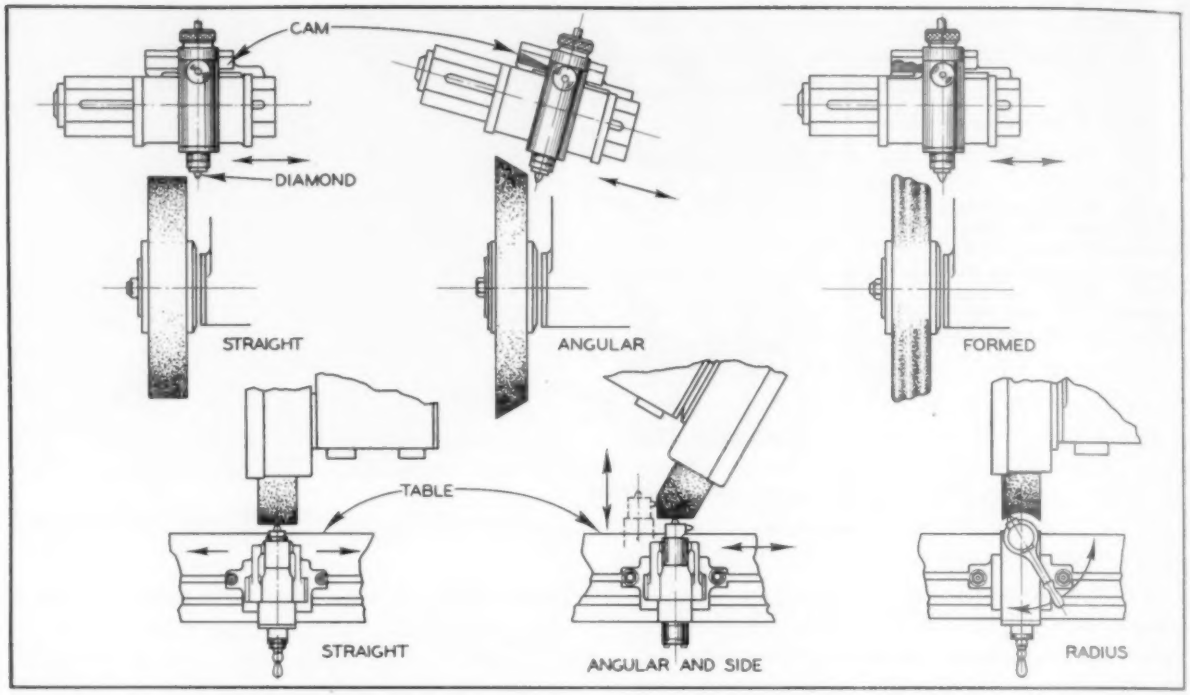


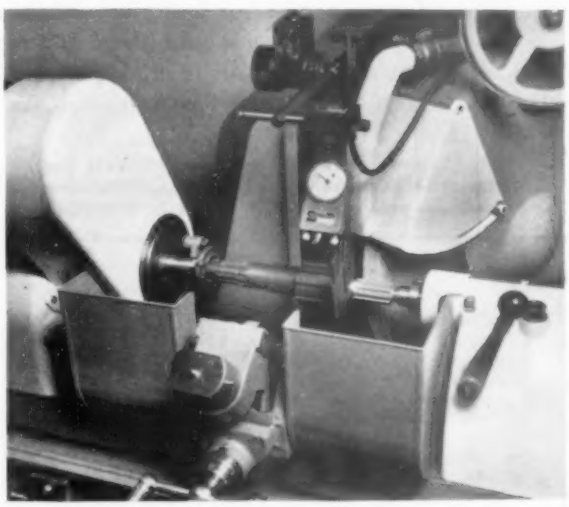
Fig. 7. Abrasive-wheel dressing devices are made in a variety of styles, usually of the wheelhood or table-mounted types.

diameter and the face of the wheel. With this operation, an electronic sizing gage is used to control the in-feed of the wheelhead. It operates as follows: After the grinding cycle is started the caliper frame of the gage is positioned over the journal being ground. The gage provides two electric limits through relays. The first limit adjustment establishes the change-over point relative to the dial graduations, which in turn changes the in-feed rate from normal to ultra-fine. The second limit adjustment determines the point at which the in-feed stops, either to dwell for a spark-out period or to immediately return the wheelhead to its rear setting. In using the gage the normal wheelhead in-feed is used to about 0.0015 in. of size, then the fine feed is automatically engaged and used to finish the part to size. The gage controls the in-feed of the machine, provides two feed rates, and insures grinding to size independent of wheel wear. By means of a selector switch, the gage can be cut out of the circuit so that the machine can be operated conventionally.

Handling Low-Lot Runs

Plunge-cut grinding is applied chiefly to high-production runs, and one machine may remain set up continuously for a single operation. However, with more recent developments in grinding machine controls and operation, the use of plunge-cut grinding is being used for low-lot runs of 12 pieces, or even less, providing the parts have some similarity and that they can be processed without too many wheel changes. For example, in grinding single journals on shafts, a 3-in. wide wheel might well handle a wide variety of parts with various widths of faces. Setting up for a given piece is relatively a simple matter. With a part located between centers the wheelhead is fed in to its farthest inward position and held. The part then is ground by movement of the handwheel adjustment to the wheelhead until size is reached. The wheelhead then is returned, dial setting is made to compensate for the amount of stock to be removed, and the set-up is then ready for automatic cycling. The cycle includes rapid traverse to the start of the grind, a normal feed rate to depth or size, a dwell if desired, and finally rapid return of the wheelhead for loading and unloading.

Fig. 8. Grinding diameter and face of transmission shaft. Electronic gage controls the normal and ultra-fine feeds of the wheelhead.



Applying Anti-Static Tooling

By John Starr

STATIC ELECTRICITY HAS for many years been a dangerous and usually-unavoidable hazard in virtually all industries, since it represents a type of energy that can be accumulated by most non-metallic materials (as the result of friction, atmospheric conditions, etc.)—causing machines to lose efficiency or to stop operating, enhancing the possibilities for fires or explosions where combustible fluids or gases are used, and sometimes being directly responsible for tragic personnel accidents.

However, thanks to the current availability of radioisotopes (by-products of the vast A-bomb project obtainable through the Atomic Energy Commission at Oak Ridge, Tenn.), electrostatic hazards can be eliminated for most practical purposes at a fractional cost.

Those radioisotopes which emit alpha and beta (or positive and negative) particles are, for obvious reasons, most useful in neutralizing electrostatic charges; and, as a rule, these materials can serve the subject purpose as follows:

(1) By more or less direct contact with surfaces which tend to accumulate electrostatic charges.

(2) By ionizing secondary mediums, such as atmospheric gases, so that the latter will contact and neutralize the unwanted electrical particles.

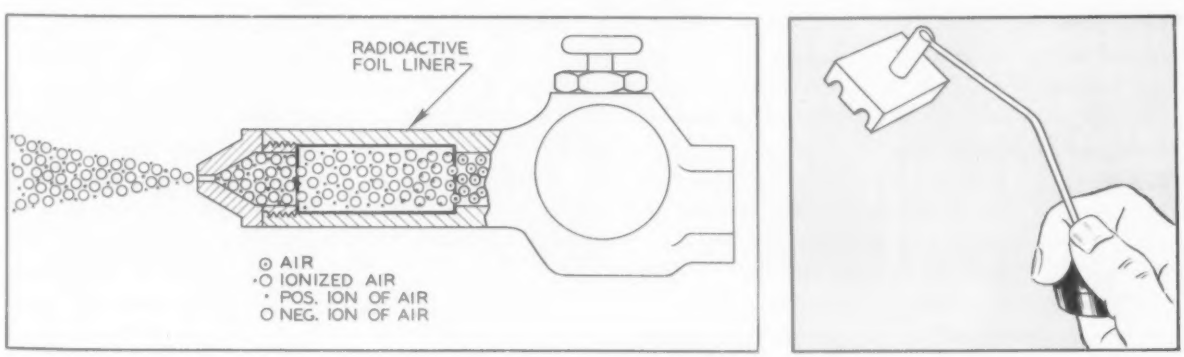
A typical method of using the first of the above methods consists of electroplating a metallic strip or form with a radioisotope such as radioactive polonium, shielding the latter coating with a thin layer of metal such as gold, and using either manual or automatic techniques to place the plated component on or near the surfaces which tend to acquire electrostatic charges—either constantly or at periodic intervals.

A good example of the second method has been provided by Canadian Radium and Uranium Corporation in the form of a blow gun, which has a radioactive foil liner (similar to the plated coating described above) for the ionization of a jet of air. The ionized air is, in turn, directed at the surfaces which would normally accumulate electrostatic charges.

Small quantities of radioisotopes are required in any event. For example, a standard bar coated with one millicurie of polonium per square inch can serve most discharge purposes because one millicurie of polonium can emit 37,000,000 alpha particles per second.

Protective coatings, such as one or two microns of electroplated gold, preserve the radioactivity of radioisotopic materials—much the same as the strength of a magnet is preserved with a "keeper"—without completely eliminating the radiations which are essential to the neutralization of electrostatic charges.

At the left, schematic side view of "blow gun" with radioactive foil liner. Liner ionizes a jet of air for the dissipation of electrostatic charges. Bars or forms of the type shown at the right have radiosotope-plated surfaces of gold and other materials are used to preserve and protect radioactive surfaces for prolonged usage.



Measuring and Interpreting the Factors in Tapping Torques

By Allen J. Carruthers
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Part II

IN ORDER TO MORE accurately provide some answers to the many perplexing questions involving the interpretation of tapping torque and the separation of these tap forces, a number of specific tests were conducted, in which all tapping torque values represent the maximum torque expressed in inch-pounds. For each individual test, a minimum of fifty tapping torque measurements was made, the averages of which are presented in these data, generally as individual oscillograms.

Partly to accelerate investigation, and because of the extreme number of tests involved to adequately justify the results, only two standard tap sizes were used. The national coarse thread size selected as a typical popular size is represented by a 3/8-16 NC M-2 high-speed-steel commercial ground tap. In order to show certain torque effects exhibited in tapping national pipe threads, a standard 1/8-27 N.P.T. high-speed-steel commercial ground tap was also selected.

The taps selected for these tests were specially prepared in an attempt to reduce to a mimimum, if not completely eliminate, all variables normally encountered and allowed in regular tap manufacturing. They were then tested under precisely controlled known conditions.

The first of these tests was designed to show the relative tapping torques produced in tapping a 3/8-16 NC thread at sixty, sixty-five, seventy, seventy-five and eighty percent thread depths in gray cast iron, Timken "Graphmo" tool steel annealed, and SAE 1020 material, at a constant tapping speed of 60 sfm, using sulphur base cutting oil. The plug hand taps used had precision index ground hook angles of 4½ deg. These results are summarized in Fig. 4 for the three materials respectively.

From these oscillograms it is apparent that the maximum tapping torque increases with the percentage depth of thread at an increasing rate for the cutting of metals like "Graphmo" tool steel and low carbon steel, but at a nearly constant rate for the cutting of cast iron.

Duplicating this same test in every respect, except using taps having an 11 deg hook angle, a very similar comparative effect was found in the three materials as a function of the percentage of thread tapped. As summarized also in Fig. 4, it is seen that the effect on the maximum torque between each of the three materials, as affected by the two different hook angles, shows relatively no difference for the cast iron. However, for both the tool steel and the SAE 1020, the torque again increases with the percentage depth of thread, at an increasing rate, showing a considerably lower maximum torque with each percentage depth of thread for the 11 deg hook angle measurements.

Tapping Speed Effects

Another series of tests were conducted to determine the relative effect of various tapping speeds on the tapping of the same three materials. These tests consisted of tapping each of the three materials with 3/8-16 NC plug hand taps having 4½ deg hook angles and tapping 75 percent of thread using a sulphur base cutting oil. The results of these tests are charted in Fig. 5 for the cast iron, tool steel, and SAE 1020 materials respectively. Here it will be seen that for the cast iron there is virtually no change in tapping torque as speeds are increased from 150 to 600 rpm. However, an examination of the tapping torque oscillograms, for both the tool steel and particularly for the SAE 1020 steel, tends to show a progressive increase of average torque with the speed, although the maximum torque reached in all cases is very nearly the same. The contour of the torque patterns in nearly every case and again, particularly with the SAE 1020 steel, shows a very sharp rise in torque occurring just

prior to the prejection of the chamfer of the tap through the plates. This would indicate a strong torque influence due to a combination of the maximum accumulation of chips and the forces acting upon them at this point.

Carrying these tests further in an attempt to account for these peculiar effects, test plates of both the tool steel and the SAE 1020 steel were tapped with 3/8-16 NC high-speed plug gun taps at 75 percent thread depths using sulphur base cutting oil. The same variable tapping speeds of 150, 225, 300, 450 and 600 rpm were used. The results of these tests are also charted in Fig. 5.

These results show virtually no change in tapping torques as affected by the increasing tapping speeds but, because of the difference of tap design related to the shear angle, chip formation, and the work done on the chips, there is no increase of torque prior to the exit of the tap chamfer through the underside of the plates.

Another test was conducted to determine the relative tapping torque effect in tapping cast iron with both 3/8-16 NC high-speed-steel plug hand and plug gun taps. Torque measurements were made tapping 75 percent of thread at 60 sfm, using sulphur base cutting oil. These results showed no marked difference in torque or in the contour of the torque oscillograms with either style tap. Due to the nature of the chips produced in tapping cast iron, these measurements readily indicate that the form, disposition of, and work done to the chips, appears to have a controlling influence on the tapping torques of all materials that produce continuous chips.

It seemed desirable, at this point in the test program, to show the effect on tapping torque, in a particular material, as a function of various coolants. It is the general procedure, for most commercial tapping of cast iron, to perform this operation dry. A number of tapping tests were performed in 9/16 in. gray cast iron with 3/8-16 NC high-speed plug hand taps having a 4½ deg hook angle and tapping 75 percent of thread at 60 sfpm with sulphur base oil, a soluble oil, sixty pounds of air blast, and dry. Result tests are indicated in Fig. 6.

It can readily be seen, as the tapping progressed from dry, air blast, and soluble oil, to the sulphur base oil tapping, that there was a very pronounced decrease in the resulting tapping torques. The relative torques, based on the torque produced with the sulphur base oil, as the lowest or basic value, show that, with the soluble oil, air blast, and dry types of tapping, they were 17, 20 and 35 percent higher respectively than the basic torque exhibited by the sulphur base oil.

Lower Torque Raises Efficiency

It is generally conceded that the lower the tapping torque, the higher the tap efficiency becomes, resulting in longer tap life. This premise has been greatly substantiated as a result of these and other tests conducted during the past three years. However, there are many extreme conditions encountered in tapping which would alter this theory.

Another test was devised to show the effect of true contour of the tapping torque oscillograms as a result of various standard tap chamfer angles. For this test, 3/8-16 NC high-speed commercial ground taps having regular plug, plug gun, bottoming, and taper style chamfers were used in tapping 9/16 in. "Graphmo" tool steel at 75 percent of thread at 60 sfpm, using sulphur base cutting oil. As would be expected, little appreciable difference was found in the maximum tapping torques between taper, plug, and bottoming chamfer style taps. From the angular slope of the contour of the torque diagrams made, there is evidently a distinct relationship of these

Fig. 4. Effect of thread depth percentage on tapping torque (3/8—16 NC HSS plug tap; tapping 9/16 in. stock at 60 sfm; sulphur-base cutting oil). Fig. 5. Effect of speed variation on tapping torque (3/8—16 HSS plug tap; 4½ deg hook angle; tapping 75 percent to thread depth in 9/16-in. stock; sulphur-base cutting oil).

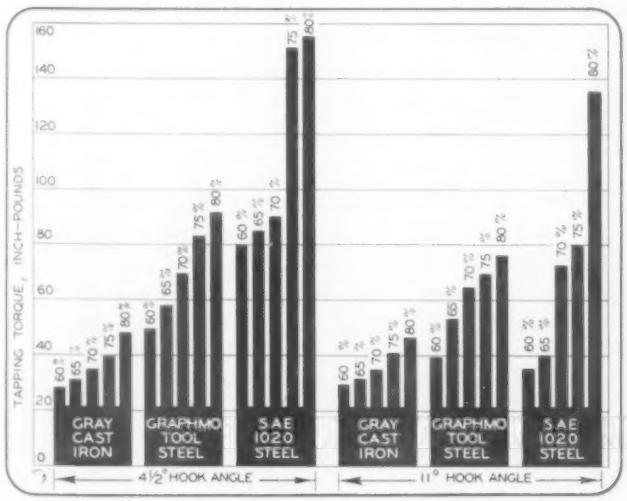

Fig. 4

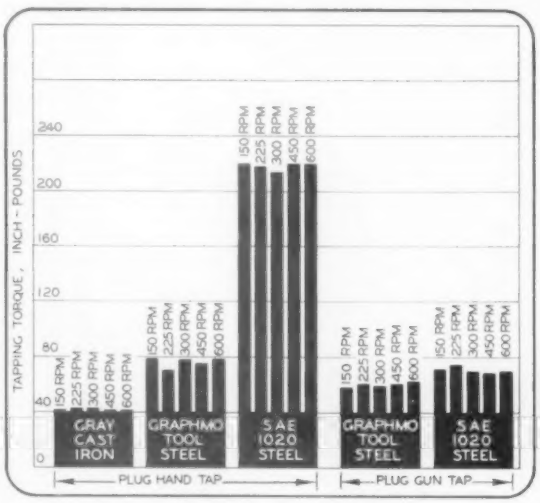

Fig. 5

angles to the actual chamfer angles on the four different style taps. However, there was a similarity of slope angle for the plug hand and plug gun taps. This is true because each of these two different style taps have approximately the same chamfer angle but a different style of fluting.

Function of Grinding Method

Another series of tapping torque tests were conducted to show the effect on the magnitude of the tapping torques as a function of three distinct methods of chamfer grinding. Typical tapping torque oscillograms were produced in the tapping of 9/16 in. cast iron, "Graphmo" tool steel and SAE 1020 steel with 3/8-16 NC high-speed commercial ground plug hand taps having 4½ deg hook angles and tapping 75 percent of thread at 60 sfpm, using sulphur base oil. In each of the three diagrams, the form and magnitude of tapping torques produced from taps having chamfers ground free hand, by an old style production machine method, and by the most modern automatic chamfer grinding machine were shown. For all three materials the torque relationship is precisely the same (see Fig. 7), showing the highest torque produced from those taps chamfer ground free-hand. Somewhat less torque is shown by the old style of production machine chamfer grinding, while the lowest and most uniform torque is exhibited by those taps chamfer ground on the automatic chamfer grinding machine. The reasons for these differences can be accounted for by the greater accuracy and the accompanying superior surface finish of the taps.

Another test involved tapping 9/16 in. "Graphmo" tool steel for 75 percent of thread at 60 sfpm, with standard 3/8-16 NC high-speed commercial ground plug hand and plug gun taps, using sulphur base oil. The respective tapping torque oscillograms showed the average relationship between these two style taps under the particular test conditions used. In general, the plug gun tapping torque was approximately 26 percent lower than that of the plug hand tap. There was also produced a tapping torque oscillogram recorded at five times the normal chart speed or 125 millimeters per second for the plug hand tap. This type of high-speed record assists greatly in torque analysis. Included with these two oscillograms was a third measurement obtained under duplicate plug tapping conditions, as above, which showed the resulting torque obtained when a sufficiently dull tap becomes loaded. It was quite obvious that this torque pattern indicates the approach of tap failure.

The effect of misalignment between the tap and the hole, as previously referred to, unquestionably affects tap life and efficiency to a great extent. In order to show how this factor may affect the resulting tapping torque, a test was made tapping 9/16 in. cast iron with a 3/8-16 NC high-speed commercial ground plug hand tap having a 4½ deg hook angle

(Continued on page 40)

Fig. 6. Effect of coolants on tapping torque (3/8—16 NC HSS plug hand tap; 4½ deg hook; tapping 7/8-in. C.I. stock, 75 percent thread depth, at 60 sfm). Fig. 7. Effect of chamfer grinding method on tapping torque (3/8—16 NC HSS plug tap; 4½ deg hook angle; tapping 75 percent thread depth in 7/8-in. stock at 60 sfm sulphur-base oil). Fig. 8. Effect of misalignment on tapping torque (3/8—16 NC HSS plug hand tap; 4½ deg hook; tapping 7/8-in. C.I. stock, 75 percent thread depth, at 60 sfm). Fig. 9. Effect of speed on torque in taper tapping (1/8—27 NPT HSS tap; 0.339-in. straight reamed holes tapped to flush gage; sulphur-base oil).

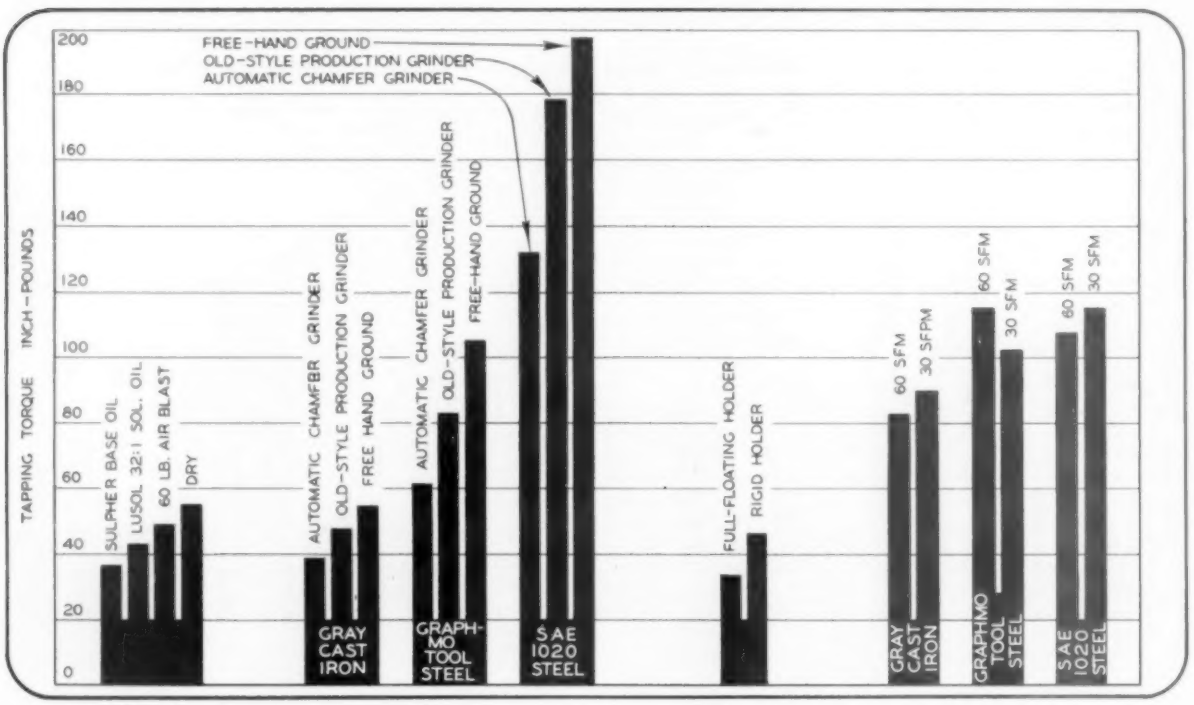

Fig. 6 Fig. 7 Fig. 8 Fig. 9

Tumble Finishing Technique

By Hubert M. Goldman

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BARREL FINISHING OPERATIONS can be most readily separated into two types; i.e., that which causes the removal of portions of the surface and that which acts only to compact the surface or to produce plastic flow of a thin layer of the surface. The first of these types is most generally referred to as "tumbling" or "abrasive tumble finishing", while the second type is commonly known as "burnishing". While barrel burnishing is primarily utilized for the production of a bright finish, it is accompanied by the compacting of the surface layer which is occasionally the desired result.

In both types of barrel operations, the work obtained is the product of the pressure on the surface and the movement of the parts within the mass. For burnishing, it is most desirable that the pressure, or in other words, the weight load of the mass, be as great as possible and the movements as short as possible. Since the conversion of weight to pressure varies with the contact area, it should be apparent that the ball would offer the best shape as a medium of burnishing. Also, the larger the ball, the greater would be the pressure. However, the size of the medium must necessarily be such that all surface area is contacted and that the plastic flow limit of the material is not exceeded. Other shapes such as eggs, balcones (which are combinations of balls with one or more cones), and round-end pins are often used in order to make contact with all surfaces. Flat faced media are seldom used except when very soft materials are being finished.

Both dry and wet burnishing operations are regularly used with specific advantages. Wet burnishing appears to offer a slight, general advantage in that one size and weight of media can be effectively utilized for a variety of results by varying the physical conditions of the liquid in the mixture. A liquid such as a soap solution or a glycerine and water mixture can readily be altered to have higher or lower viscosity and therefore to offer greater or lesser cushioning between the particles of the mass.

In abrasive tumble finishing, the pressures within the barrel and the amount of movement between the particles of the load can be varied considerably to produce a wide range of results. The size and shape of the media offer almost unlimited variation of both pressure and movement. The media material, by virtue of its specific gravity, or more correctly its "apparent density", determines pressure and, by virtue of its frictional resistance against the parts, determines the degree of movement. The liquid or solution used in the barrel can be readily altered as in burnishing and also by the addition of thickening or wetting agents so as to increase or decrease the friction between particles of the mass. Also, the diameter of the tumbling container, by virtue of its larger or smaller capacity, and the speed of rotation of the cylinder as well as its shape, will alter both pressure and movement.

Compounds Effective

In abrasive tumble finishing, it is possible to use media which are abrasive compounds. A common abrasive medium consists of lumps of aluminum oxide abrasive just as it is taken from the refractory furnace except that the lumps are self tumbled to cause the breakdown of all shatterable pieces and to round off all sharp points and edges. The material is furnished in a variety of screened sizes ranging from 1½ to 2 inches down through No. 16

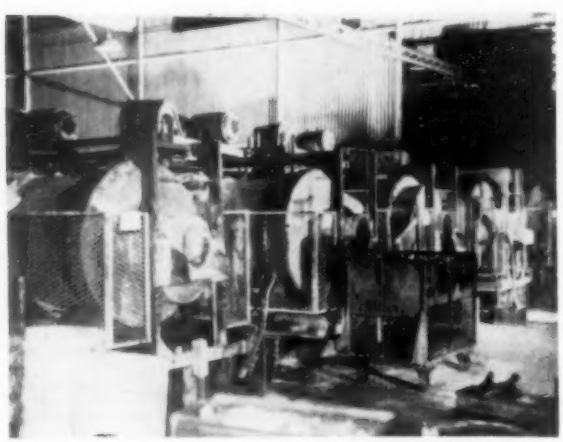
Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

and No. 20 mesh or even smaller sizes for special applications. Since the material is 100 percent abrasive, it is only necessary to keep it clean in order to obtain continuous abrasive action. The gradual wearing down in size of the particles will necessarily reduce the speed of any particular operation by increasing the number of contacts and thus reducing the unit pressure. However, these smaller particles can most generally be screened out and used to advantage in other specific operations. The larger sizes are capable of fast cutting or deburring of practically all metals. The medium sizes offer particular advantages in breaking corners, blending chamfers and radii, and producing reasonable low micro-inch surface finishes. The smaller sizes are most generally used to obtain reasonably smooth and partially burnished surfaces, to decrease the micro-inch readings on surfaces previously tumbled with larger sizes of the abrasive, and intermixed with the larger sizes, to make contact with internal fillets or other surfaces which would not be touched by the larger particles.

A second abrasive medium consists of particles of No. 400 to No. 600 mesh aluminum oxide or carborundum embedded in a binder, such as the ceramic normally used for grinding wheels. These stones are also produced in the pretumbled, blocky shape and in many sizes. While their action is akin to that of the pure alundum, the softer binder does reduce the rate of abrasion; but, at the same time, it allows even finer finishes to be obtained if longer tumbling times are used. Some work has also been done with rubber-bonded abrasives, but it is believed that this material offered no outstanding advantages.

A variety of semi-abrasive tumbling media in the form of mined materials is also available. Most generally these materials are geological intermediates in the granite to mica-schist range or the limestone to black marble range. They are generally furnished as sized particles having a somewhat more slivery or less blocky shape than the manufactured materials. Fine abrasive compounds are generally added with these stones if a definite abrasive action is required. The granite type materials are used primarily for rough operations such as deburring or the removal of casting flash; and, consistent with the results obtained, the stones break down rather rapidly. It is the writer's belief that very few tumbling jobs can ever be done as satisfactorily with this material as with the lump aluminum oxide. The limestone chips or stones also tend to be somewhat slivery in shape and are generally used with added fine abrasives except when a burnishing operation is being conducted. These chips definitely do not offer the fast cutting rate of the aluminum oxide stones, but they do produce a more brightly finished or burnished surface when properly used.

Fig. 1. Battery of Semi-automatic Ransohoff Tumble finishing machines with rubber lining.



Non-Abrasives Common

Tumbling media of a non-abrasive type in common use today are: broken coconut shell, walnut shell, die-cast zinc and cut rolled zinc shapes, lignum vitae shapes, unglazed porcelain shapes, hard wood pegs and balls, soft steel or iron balls and pins, and even cracked ice or dry ice. Most of these materials, like the true abrasive and the semi-abrasive stones, are used in wet operations and fine abrasives are generally added except for the final burnishing operations. Sometimes, however, a completely dry operation with these materials is necessary as in the case of flash removal from molded rubber articles by tumbling with dry ice. These non-abrasive media offer superior results in obtaining highly burnished finishes where a reasonably smooth finish has previously been obtained either by abrasive tumbling or by other means.

From the above, it is apparent that an important technique of the art is the choice of the proper tumbling medium to obtain a given result or finish. Occasionally, two or more types of media will produce the required finish, but it will then most generally be found that one medium will offer a faster operation. Quite often, far superior results can be obtained with two separate operations, each with a different medium, than by trying to obtain the finish in two or even three operations with the same stone.

Next in importance to the type of media is its size and possibly its shape as in the case of the non-abrasive materials. The particle size and shape must be so chosen that all significant surfaces of the part being tumbled are readily contacted. The contact pressure as determined by the size of the particle must also be considered in relation to the work desired or the type of finish wanted. The total weight or volume of the media within the barrel is also of importance and will be discussed in conjunction with operating techniques.

Since the finishing results which can be obtained with any one type of tumbling medium can be varied over a significant range by altering the liquid in the barrel, this choice of liquid is important. While solutions such as lubricating oil, kerosene, molasses in water, glycerine in water, and similar liquid mixtures are occasionally used, most wet tumbling operations today use water solutions of various proprietary chemical mixtures containing soaps, mild alkalis or acids, detergents, wetting agents, foaming agents, sequestrants, deoxidizing chemicals and the like. Many experimental tests were conducted before such products were placed on the market; and it is, therefore, advisable to ask the advice of the manufacturer rather than incurring heavy expenditures for specific experimentation. In general, the solution should be a good cleaner if abrasive action is required, so that the medium and the parts are kept as clean as possible throughout the operation. For maximum abrasion, the solution should have no cushioning effect such as may be produced when the compound contains foaming agents and fair concentrations of wetting agents. Very little wetting action is required for cleaning, since practically all surfaces are being mechanically scrubbed throughout the operation. For burnishing or extremely light abrasion, the use of foaming agents, soaps, or similar cushioning materials is necessary. Finely powdered abrasives such as alundum flours or powdered pumice are often mixed with the proper chemicals in proprietary compounds intended for use with nonabrasive media.

Quantity Alters Abrasion

The amount of solution or liquid in the barrel relative to the volume of the parts and medium also alters the degree of abrasion. A low liquid level will necessarily offer a thinner liquid film between the particles of the mass and thus allow greater abrasive action. A high liquid level not only increases the liquid film thickness but also increases the hydrostatic pressure tending to separate the particles. Thus high liquid levels are generally used with burnishing operations. Occasionally, the cushioning action of the liquid is used to prevent excessive abrasive action on certain flat areas while allowing good action on outside corners or edges. This property of the liquid may also aid in the tumble finishing of articles which might readily be bent because of lack of equalized pressures at all points. The tumbling-medium particle size is also very important in such cases.

Although many operators are using the oblique open-end type of tumbling barrel, better and more consistent results can be obtained in the horizontal closed units. The diameter of the barrel may occasionally be of special importance. Generally, however, regularly produced units of 18-in. diameter or larger are used. The larger diameters will necessarily handle larger production lots as well as offering heavier pressures and resultingly shorter tumbling times. Since most units today have cylinder diameters of 28 to 36 in., it should be apparent that, when all conditions are considered, a barrel within this range must offer the most economical operation with respect to tumbling time, handling, and first cost of equipment. A new unit only recently made available has a barrel diameter of 40 in., but is so designed that the floor area requirements are no greater and the loading height is no greater than for the previously supplied 36-in. diameter machine. This larger diameter handles a 30 percent larger work load and reduces the processing time as much as 25 percent. The width of the barrel or barrel compartment is most generally determined by the usual production lots of the parts to be tumbled, but it should be noted that this dimension should never be less than twice the longest dimension of the item to be free-tumbled.

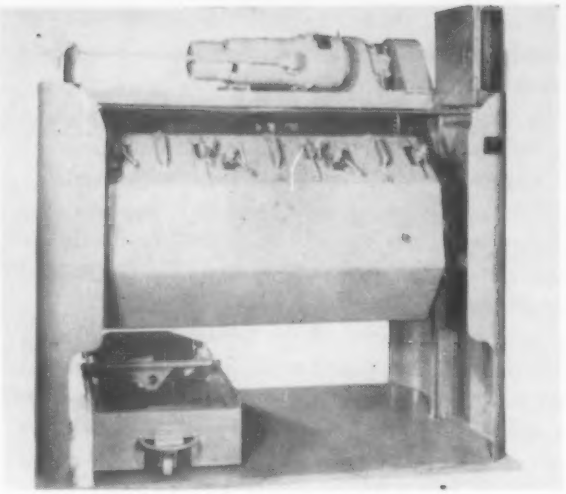


Fig. 2. Three-compartment variable speed drive crown tumble finishing machine equipped with fully automatic timer to control tumbling cycle.

The speed of rotation of a cylinder of any given diameter can, within certain limits, be varied according to the part and the work to be done. At no time should the speed be so great as to throw the parts or the tumbling media. Low speeds are used for light-gage, easily bent parts and for the primary removal of heavy burrs. Light, soft metals such as aluminum also suggest the use of low speeds. Higher speeds allow faster action for removal of light burrs, casting flash, or forging fins where the metal will not be rolled over before being removed, and for surface finishing or burnishing with smaller or softer media. The usual speed range for a 36-in. diameter cylinder is from 10 to 24 rpm. The maximum speed at which a small cylinder can be revolved before centrifugal force changes the action is

70 rpm. As might be expected, the semi-abrasive or non-abrasive media can be used at higher rotational speeds.

In the actual operation of a tumble finishing barrel, the parts and the tumbling media should be so loaded into the barrel that they are reasonably well mixed before tumbling is commenced. The relative quantities of parts and tumbling media for maximum output can actually only be determined experimentally.

Since one purpose of the tumbling media is to keep the parts separated at all times, it is apparent that volume measurements of parts and media must be used. For small parts, the volume should be determined by random arrangement of the parts in a cubic container of fair size. The volume of larger parts is considered as the produce of the three largest perpendicular dimensions. The ratio of media to small parts will usually fall between 2 to1 and 5 to 1, while ratios for large parts will be between 4 to 1 and 10 to 1.

Having estimated the respective volumes of parts and media, the cylinder is then filled to approximately 60 to 70 percent of its volume for normal operation. If parts are lacking, the excess volume is taken up with more of the tumbling medium. Lighter loads are never used to advantage. Heavier loads may be used when it is desirable to reduce the action with respect to the amount of motion within the mass.

The proper amount of a specific chemical compound, based on manufacturer's recommendations, is then added along with sufficient water to give the correct liquid level as previously discussed. After sealing the cylinder, its rotation is begun. For a 36-in. diameter barrel, the most used rotational speed is 20 rpm. The time required for the operation is necessarily determined experimentally, but Table I shows some time limitations for various operations with a few types of media.

Following the completion of the tumbling operation, it is advisable to drain the dirty liquid by use of a screened door and to rinse the entire contents in the barrel at least twice before dumping and separating by any suitable means. These rinsing operations will leave the tumbling media in a clean condition and ready for the next load.

TABLE I—RANGES OF PROCESSING TIMES

Operation	With Natural Stones	With 100% Aluminum Oxide
Deburring	¼ to 12 hours	¼ to 8 hours
Grinding	8 to 48 hours	2 to 100 hours
Polishing	¼ to 16 hours	*
Burnishing	¼ to 3 hours	¼ to 1 hour
Average for Deburring Stamped Steel	¼ to 4 hours	¼ to 2 hours‡

* When using aluminum oxide, polishing and grinding can not be differentiated.

‡ Higher color can generally be obtained with the natural stones hence, longer runs may be desirable.

Measuring and Interpreting the Factors in Tapping Torque

(Continued from page 36)

and tapping 75 percent of thread at 60 sfpm with sulphur base cutting oil.

In this test, where a certain amount of misalignment at the tap was known to exist, all other conditions were held constant except for the type of tap holder. As shown in Fig. 8, the tapping torque record resulting from the use of a rigid type tap holder was approximately 28 percent higher than that produced by the same tap operating in a type of full-floating tap holder. This result, representing somewhat of an extreme condition perhaps, is one that exists in many commercial tapping operations.

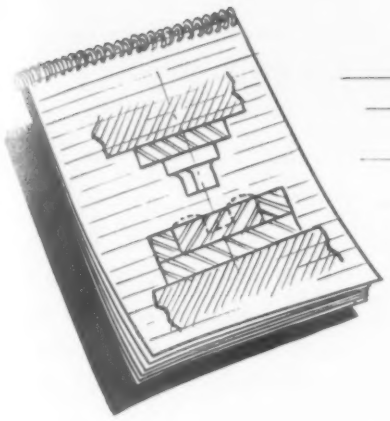
These tests would not be complete without some reference to the tapping of taper pipe threads. Therefore, in Fig. 9 there are summarized the maximum torques developed in the tapping of ½ in. gray cast iron, "Graphmo" tool steel, and SAE 1020 steel with standard ⅛-27 NPT high-speed commercial ground taps. For each of the three materials, torque measurements were made at tapping speeds of approximately 30 and 60 sfpm, to the same thread gage depths. The oscillograms show slight variations in the maximum torque at these two tapping speeds but they may be considered the same.

In general, these measurements show that taper pipe threads require slightly more than twice the torque of straight threads of the same diameter and pitch.

An examination of all of the oscillograms developed in this test, and particularly the one resulting from the tapping at 60 sfpm with a chart speed of 125 millimeters per second, showed the presence of reverse torque occurring immediately after the tap reversal, due to the shearing of some of the metal of the incomplete threads. Possibly some of this reverse torque also may be attributed to chip interference.

Values such as those in the foregoing data may be readily obtained by the use of the SR-4 strain gage tapping dynamometer and are helpful in surveying the important changes in tap design and operating variables. However, as already mentioned, such tests must be supplemented by some life tests.

The information contained in this paper is preliminary in nature and represents some of the fundamental research in progress to provide answers to the many problems confronting industry today in the manufacture and use of taps.



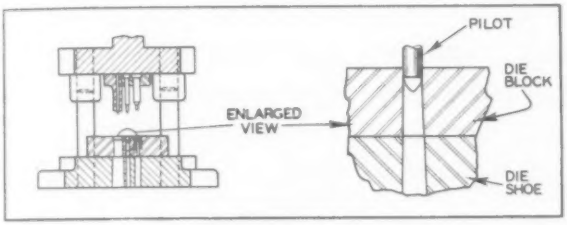
A notebook on die design....

By John S. Brozek
SARGENT AND COMPANY

Part IV

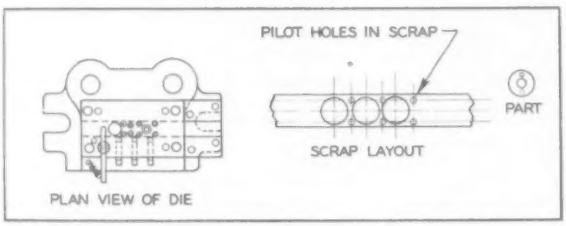
5. Scrap Holes for Pilots

As it is unavoidable to have misfeeds, pilots will push scrap down into the holes. Therefore, these holes should be carried all the way through the die block and die set being tapered reamed as shown.



6. Has Proper Piloting Been Provided For

The success of a "Progressive Die" depends largely upon pilots for accuracy of finished part. Special holes for pilots in the scrap are advisable even though it adds to the cost of the die and amount of material used.

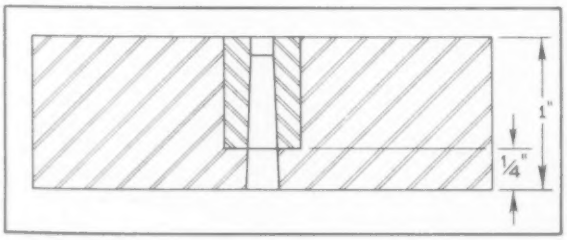


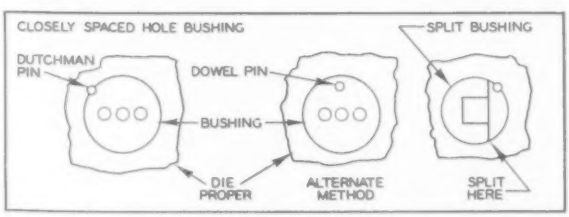
7. Perforating and Piercing Dies In Class AA and A Should Have Bushings

It is advisable to bush all perforating and piercing holes in the die block for ease in replacement upon breakage or wear.

Bushing should be made long enough to allow for regrinding of die, having sufficient bearing in die proper.

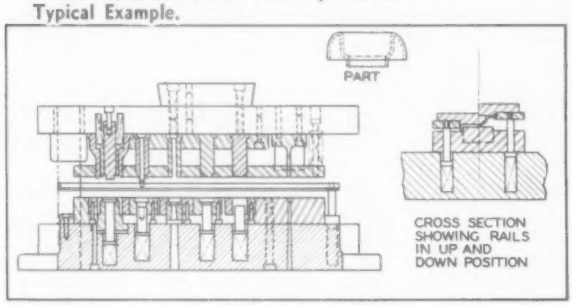
Correct Bushing Application





8. Do "Succeeding Stages" Allow Adequate Clearance for Extrusions or Bends Previously Formed

Typical Example.



9. Conditioning the Die Bed for Die Scrap and Slug Holes

Drilling out holes larger than the slug is not the answer. Slugs have a way of catching and wedging. If holes are smoothly tapered reamed and have no steps or pit holes, the slugs will never jam which results in punch or pilot breakage. In cast iron sets, steel bushings can be inserted if blow holes exist in the die bed.

10. Punch Plate Thickness

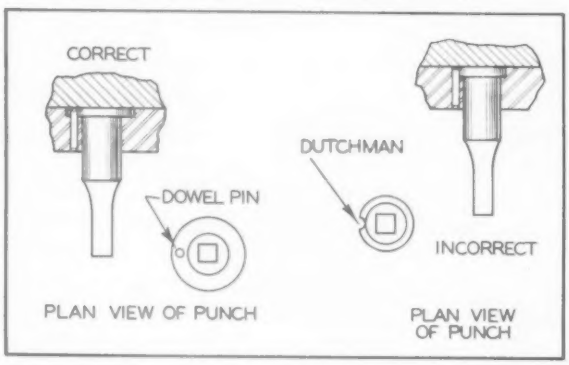
Punch plate thickness must be of ample thickness, particularly when not guided in the stripper. Punches ½ diameter cannot be properly supported in a plate less than ¾ in. thick. Small punches down to 3/16 or ¼ body may have to have the same thickness of punch plate for support to add stability upon impact of the punches against the material pierced, especially this is true of small diameter hole punching. The sturdier the punch plate, less alignment trouble will be encountered upon replacing punches.

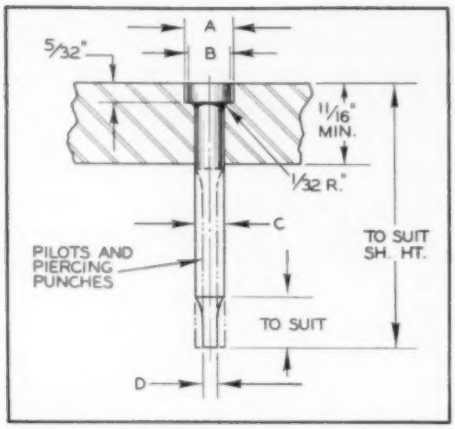
11. Punch Plate Material

The punch plate is left soft, therefore, one is inclined to think that it can be made of any material. This, however, is not so, when accurate boring of holes is necessary. The best grade of tool steel should be selected. This will result in saving jigboring time as well as getting a more accurate job.

12. Punch Shank Location

For proper location of special shaped punches, oval, rectangular, square, etc., a dowel through the head of a punch is more positive for proper positioning than a "Dutchman" which goes half and half in the shank and punch plate.

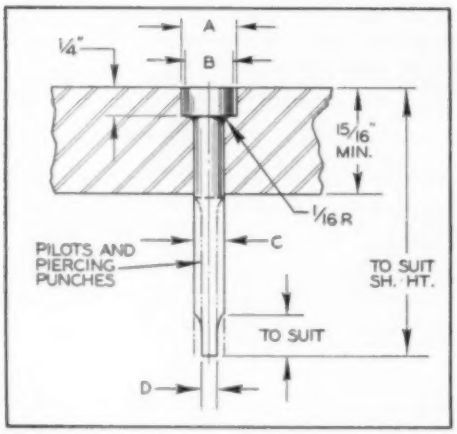




PROPER PUNCH HOLDER DESIGN

Punches for Piercing Metal Up to 3/32 Thickness

DIA. A	DIA. B	DIA. C	DIA. D
0.375+0.005	0.375—0.005	0.2505+0.0003	0.031 thru 0.250
0.500+0.005	0.500—0.005	0.3755+0.0003	0.251 thru 0.375
0.625+0.005	0.625—0.005	0.5005+0.0003	0.376 thru 0.500
0.750+0.005	0.750—0.005	0.6255+0.0003	0.501 thru 0.625
0.875+0.005	0.875—0.005	0.7505+0.0003	0.626 thru 0.875
1.000+0.005	1.000—0.005	0.8755+0.0003	0.751 thru 0.875
1.125+0.005	1.125—0.005	1.0005+0.0003	0.876 thru 1.000

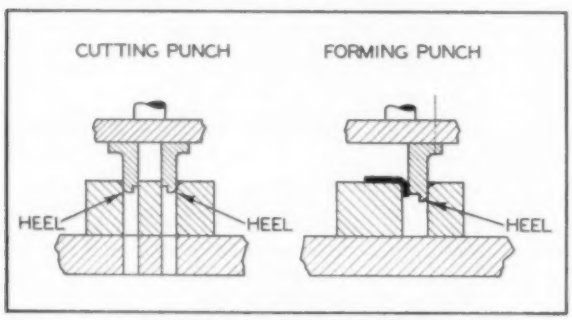


Heavy Duty Punches for Piercing Metal Over 3/32 Thickness

DIA. A	DIA. B	DIA. C	DIA. D
0.437+0.005	0.437—0.005	0.2505+0.0003	0.094 thru 0.250
0.562+0.005	0.562—0.005	0.3755+0.0003	0.251 thru 0.375
0.750+0.005	0.750—0.005	0.5005+0.0003	0.376 thru 0.500
1.000+0.005	1.000—0.005	0.7505+0.0003	0.501 thru 0.750
1.250+0.005	1.250—0.005	1.0005+0.0003	0.751 thru 1.000

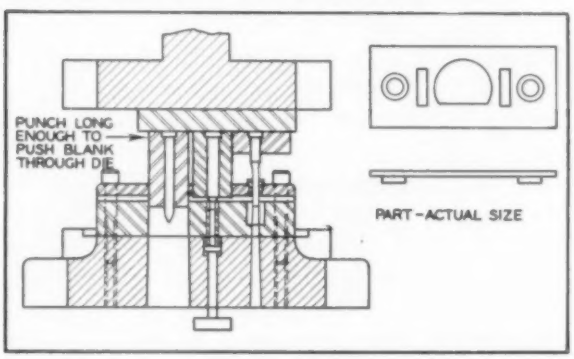
13. Backing Up Punches With Side Strain

Punches cutting on one side only should be heeled, the heel entering the die for support before any cutting takes place. The same condition may arise with forming and shaving punches. Shaving on one side only should be avoided. Forming punches should be backed up solid in some manner. Dowels as a rule are not sufficient.



14. Does the "Blank Have to Be Pushed Through"

When the blank has a bent lug, formed surface, or extruded section, the designer must provide a long enough punch to push each part through. This is not advisable unless it is necessary to eliminate bending out of shape the blank.



15. Punch Life or Length

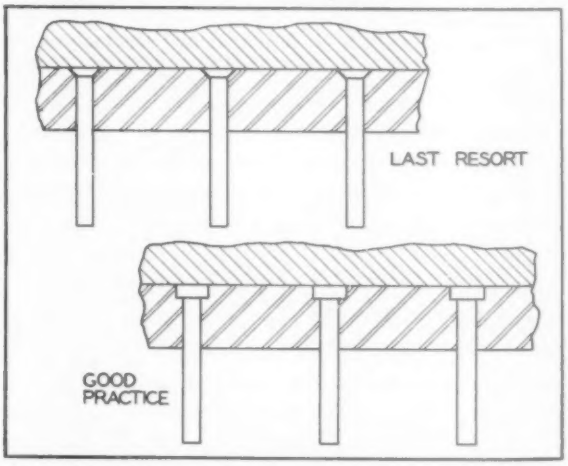
Making short punches is one way of cutting cost of dies. Dies made for long production should have punches long enough to allow for ½ in. to 1 in. grinding. A frail punch, however, must be made short to give maximum strength.

16. Punch Shank Should Be Ground

All punch shanks should be ground to proper drive or tap fit. Headed punches should have a snug or slight clearance around the head hole. With this in mind, no trouble should be encountered in assembling or disassembling of punches on replacement or servicing.

17. Angle on Headed Punches

A 60 deg included angle seems to stand up best. However, experience dictates that angle headed punches are to be used as a last resort. They have a greater tendency to pull out upon stripping and should be avoided if possible.



18. Guiding Delicate Piercing Punches

A piercing punch held in a thick punch holder plate backed up and guided in stripper bushings will punch holes in material 30 percent to 35 percent thicker than its own diameter. The shank, however, should be at least twice the diameter of the hole being punched, and the cutting end must be the hole size for about two to four times the thickness of material.

Continuous and Automatic Gaging

By A. C. Sanford
FEDERAL PRODUCTS CORPORATION

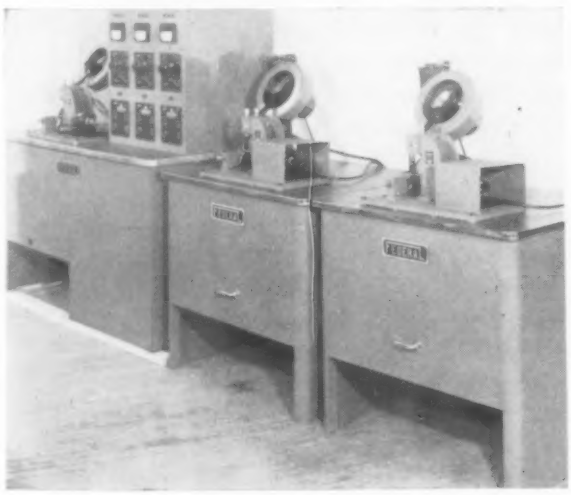
Part II

EXAMPLES OF AUTOMATIC GAGES

In the manufacture of brass pieces which are used in the printing process, it is necessary that all the pieces be kept in exactly the same position for storage. The gage accepts these parts from this neat and orderly stack, takes them one at a time from the bottom of a pile, brings them around into measuring position. Here, the depth of a character is measured and the size is impressed on a mechanical memory. The part is then carried around until it reaches the correct disposal chute, where they are sorted into four groups. At this point the memory operates the ejection mechanism causing the part to leave the gage proper. The gage then stacks the parts up in exactly the same manner as they were when they entered the gage.

Ball bearings are considered rather easy parts to handle. They are symmetrical. They require no particular orientation, and should therefore be ideal subjects for automatic gaging. This is certainly true in the case of the largest size balls, say, from 1/8-in. diam and larger. However, it is no easy matter to gage the small or miniature balls. However, a fully automatic hopper-fed gage was designed to measure the outside diameter of ball bearings between 0.015 and 0.062-in. diameter. These balls are so small that an ordinary sewing thimble would hold 100,000 of them.

Fig. 3. One of three gages designed to measure four characteristics of chain saw rivets, this unit operates at a rate of 180 pieces/min.



The gage was designed and built to measure these balls at the rate of 60 per minute. With the smallest-size balls some trouble was encountered in hopper feeding them, but this was finally solved, first of all, by introducing air pressure into the hopper to force the balls down the feed tube and then by maintaining a minimum of clearances all along the path of the ball through the gage. After the balls passed through the gage, they were sorted into six good categories, plus oversize and undersize. In this gage the categories were set so that they could be adjusted to as fine as ten millionths of an inch. Larger categories giving values of 0.0001-in. each were also available by the turn of a switch.

High Speed Sorting

The gage shown in Fig. 3 was one of three which were built to measure the four characteristics of chain saw rivets. These gages operate at the rate of 180 pieces per minute. This rate exceeds the best that any operator could possibly hope to achieve when checking four dimensions on fairly small parts such as these. This gage is fully automatic, the parts are merely loaded into a hopper, fed into a reciprocating slide which carries them between the gaging contacts and drops them down the cor-

rect disposal chute. Since the speed is quite high, the gage utilizes the electronic gage circuit to obtain the actual measurement.

Sorting Into 18 Categories

The gage shown in Fig. 4 measures the outside diameter of refrigerator compressor pistons and sorts them into 18 categories, each equal to 0.0001 in. In addition to requiring an accurate measurement and many classifications, it was also necessary that we provide careful material handling on this part. Due to the design of the refrigerator compressor, there is a flat head screw which is lapped into the head of the piston. This screw lies loosely in the head of the piston at the time the measurement is taken. It is necessary that the pistons go completely through the gage and not be tipped or jarred excessively since, if the screw falls out, all that work is lost and must be done over again. The same gage was designed so that, with a few simple adaptors, it could be used for measuring the outside diameter of a tiny wrist pin which goes into these same pistons. The number of classifications required for the wrist pins was less than that for the pistons, and the electronic components were therefore arranged so that with the turn of a switch, the gage knew whether it was measuring the pistons or the wrist pins.

Gage Attached to Special Grinder

One example of the above theory is the fully automatic gage, designed to measure four thicknesses and the warpage of a plastic switch base on one make of electric stove. The gage was designed so that it mounts immediately adjacent to the exit side of the customer's final thickness grinding machine. The incompleted parts are fed through the grinder by a chain drive. The inspection machine receives these parts as they come from the grinder, end to end, measures five characteristics on each part individually and sorts them into undersize, oversize or acceptable classifications. Before the automatic gage was installed, operators had to take the plastic switch bases, make four separate thickness measurements on a comparator and then rock the part on the flat comparator base to guess at the warpage.

Gage Built Into Production Line

An example of making the inspection machine an integral part of the final process line is shown in Fig. 5. This gage was designed to measure wrist pins for diameter and sort them into three classifications of good, plus oversize and undersize. It was designed to be mounted right in the customer's final lapping line as though it were another centerless grinder. In this wrist pin production, the parts are passed through a series of centerless grinders

Fig. 4. The OD of refrigerator compressor pistons is measured by this gage, and pistons are sorted into 18 categories by size.

and laps. They are hand-loaded at the beginning of the run and there is no need for further handling until the pins reach the end of the line. In this gage installation, a washing machine was added after the last lap and the exit side of the washing machine was attached to the input side of the gage. Then at the exit side of the gage another divided conveyor belt was mounted and the parts went right to the operators who did the final packing and shipping. The semi-finished parts enter this process at the very first grinder and continue all the way through process, through the washing, through the gaging and through a subsequent greasing and the only other time they are handled is when somebody actually puts them into the final shipping box.

Remembering and Subsequent Sorting

In the manufacture of glass tubing it is possible to obtain only an approximate control of the size. The tubing comes down the draw from the furnace through a cooling tube which may be several hundred feet long and then into a cut-off machine which cuts it into 3-ft, 5-ft or whatever lengths are required. It was formerly necessary to take these pieces of tubing and run them through subsequent gaging, either by hand or semi-automatic.

For one glass tube production line, an automatic gage was developed which attaches right to the process, measures the size of the tubing while it is still uncut, compresses that size impulse on a memory device and, when the tubing is in position ready for cut-off, the gage operates the disposal trap to direct the cut piece into the correct size classification. With this arrangement all subsequent handling for sorting purposes is eliminated. The tubing can be taken right from the process and packed for shipment. The important part of this arrangement is a memory device. The gage is located some 20 to 30 feet away from the disposal, the measurement must be made before the tubing is cut, and the gage must know where the cut-off points are going to come. This was a rather difficult

problem, but it was established that a size can be impressed on a memory, and that memory can be synchronized with a forward motion of the tubing.

There are cases where the automatic gage design can be extended and improved to the point where the gaging unit can be mounted in the manufacturing line and set up so that it will automatically adjust the manufacturing machine so that all parts are produced within tolerance. If the machine goes so far beyond tolerance that the gage cannot correct it, the gage can be arranged to shut the machine off. This arrangement gives an automatic check on all of the production that comes out of a particular machine or a particular line and insures that all of it will be within the required limits.

Acts as Continuous Measure

Such an automatic process control device is a continuous measuring unit which was so designed as to measure the outside diameter of plastic coated wire after it leaves the extruder. For a number of reasons, including variations in extruder temperature, and plastic consistency, wire coating extruders do not produce exactly the same size material all the time. Those who have responsibility for production planning on the coating of wire have a conflicting problem. On the one hand, the Underwriter's Laboratory sets up certain specifications for minimum acceptable thickness of the coating. The coating must always exceed this minimum thickness. On the other hand, many thousands of dollars can be thrown away each year on a single extruder for each one thousandth of an inch extra plastic applied to the wire. For that reason, the automatic extruder control gage was developed. It measures the outside diameter of the wire and is

Fig. 5. Modern gaging is built into this line so that wrist pins proceed through grinding and gaging operations without manual handling.

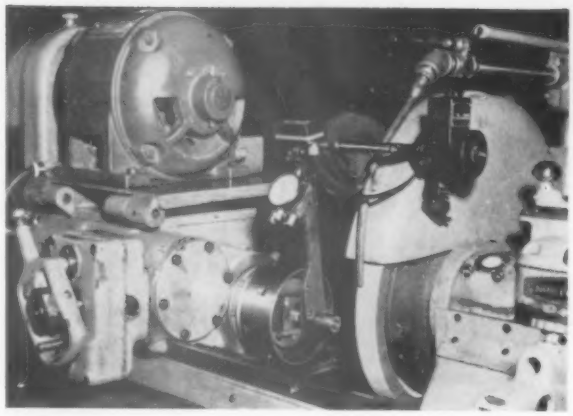


Fig. 6. This gage mounted on a cylindrical grinder, rides on the workpiece and controls the operation.

tied in with the machine controls. If the wire is coming oversize, the gage speeds up the machine to put a little less plastic on to the wire. Conversely, if the wire is coming too near to the low limits, the gage slows the machine down to put more plastic on the wire. This type of gage has proved that it will control the over-all variations on wire to a matter of about one one-thousandth of an inch. This is very good when it is considered that the normal manufacturing tolerance allowed by wire manufacturers to their own shops is on the order of five one-thousandths of an inch.

Cyclic Machine Control

An example of automatic machine control, as applied to the manufacture of individual pieces rather than continuous measurement, is the grinding gage with the electrical switch attachment shown in Fig. 6. This gage is mounted on a cylindrical grinder and rides on the workpiece while it is being ground. The electrical controls are wired through a suitable power unit into the machine controls. With this gage the operator's only function is to load part to be ground into the grinder, and snap the gage on to the unground work. In actual practice, it was set up so that the operator ran two grinders and was loading or unloading one while the other was performing its work cycle. When the gage is put on the work, it takes over the cycle completely. The grinding wheel comes in at its fast feed, switches to fast grinding feed and then, when the work is within about 0.001 in. of the finished size, the gage switches the grinders to the slow or dwell grinding feed. When the work has reached final size, the gage causes the grinding wheel to back off and the work spindle to stop. Reports from users of this gage indicate that they have obtained accuracies of better than 0.00005 in. all day long. The finished size of the part is controlled regardless of wheel wear or wheel dressing, so that all the parts produced in any one day are within a half a tenth of each other.

Statistical Aids for Tool Engineering

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Part IVa—Conclusion

TWO FEATURES OF A CONTROLLED operation are the average value and the natural spread of dimensional variations. When automatic machinery and tooling are employed, their inherent characteristics largely determine the spread. The average, at least for short periods of time, is fixed by the setting of the equipment. Over a period of time tool wear acts to increase overall range, but for individual groups, the spread is smaller. In fact, for much such equipment R or $\triangle$ charts are not used at all. For setting and resetting, the $\overline{X}$ chart is the guide.

On the other hand, where operator skill is a factor in each machine cycle, as on a turret lathe, an additional and often dominant cause of error is introduced to influence the range. For instance, where a tool or grinding wheel is brought to sizing position, manually against a stop, its action is known to be largely dependent upon the speed and force with which the wheelhead is brought forward. Human behavior is less predictable than that of a mechanism. Consequently, with hand-operated machinery, the range chart assumes greater importance.

The normal inclination of a workman is to try for the high limit of an outside dimension and the low limit of an inside dimension to avoid scrap. If an operator can be shown the advantage and safety of holding to the mean with the help of an $\overline{X}$ chart, then he can often save considerable rework. A decided benefit from control at the mean was found in one case, in that a very high percentage of normal gage wear was eliminated because it was no longer necessary to "force" go gages.

Reasonable tolerances are determined not only by requirements, but also by what can be held. Statistical methods offer the only reliable means of ascertaining the true performance limits of an operation. As long as an operation is subject to assignable causes of errors, it can be improved profitably. When errors result only from chance causes, performance can be improved only by radical changes. A control chart reveals whether or not an operation is in control (subjected alone to chance cause of error), and if so, at what average value and with what spread. If consistent information is available for a long enough time, a picture may be had of the distribution of errors. All of this provides a reasonable basis for estimating the capabilities of the operation.

Guide Performance Appraisals

For appraising performance limits, considerable help may be obtained from control charts of past production of comparable operations. If this information is lacking, statistical methods may be employed advantageously on pilot runs of new parts if the methods used for the pilot runs are similar to those intended for regular production. Thus, it may be possible to anticipate and avoid circumstances where specified tolerances are closer than attainable production results.

Strictly speaking, the natural tolerances exhibited by an operation and computed from $\overline{\overline{X}} \pm 3\triangle'$ limits give no unquestionable assurance that such tolerances can always be met. This is especially true where comparison is attempted between similar operations. No method of analysis has been found to furnish positive evidence that process behavior will continue inalterably. Rather, the only positive evidence presented has a negative tenor; to the effect that there is no reason to believe that closer tolerances can be maintained under the contributing conditions. An estimate of what the reasonable limits

for a particular operation is partly a matter of statistics and partly a matter of engineering judgment. The statistics indicate the degree of reliability of the available data; the degree of control of the process, as then constituted; and the form of the distribution of the errors. The engineering judgment is involved in deciding the possible additional circumstances that may be encountered, such as unpredictable variability of tool, machine, and operator performance and of raw materials.

Statistical methods have been used to evaluate machine accuracy. The results are especially significant for automatic machines. Where an operator guides a machine, his actions may have a major influence upon performance. For one thing, statistical quality control has been advocated as a means of checking new machines at tryout. Another application is to check machines in a plant before they are put on specific jobs, to make sure they will perform as required.

In some plants, statistical control methods have been the basis for setting up records of machine performance. For various machines of any one kind, practical tolerances that can be held are found by test runs. Feasible limits for production may be ascertained by the method illustrated by Fig. 2 of Part III or by control charts. Fig. 2 shows one way of recording practical tolerances for future reference. The variables of tool form, position, and materials are taken into account. The recorded tolerances correspond to the $\pm 3\triangle'$ limits of tests run on the machines.

Charts Aid Job Scheduling

With charts like Fig. 2, the tool engineer is in a position to assign close jobs to the most suitable machines, and vise versa. A basis is also provided for predetermining control limits.

If operator skill is involved in the operation of a machine, variations are prone to be more widespread than if operation is automatic. Charts similar to Fig. 2 might be used, but it must be recognized

Fig. 2. Records of tolerances which can be expected from specific machine tools are valuable in setting up production standards.

ACCURACY CHART FOR AUTOMATIC LATHES
TOLERANCE IN 0.0001 UNITS

MACHINE NUMBER	SIZE RANGE	TYPE AND POSITION OF TOOL											
		FRONT SIDE			CROSS SIDE								
		TURNING TOOL			FACING TOOL			FORM TOOL			CUT OFF TOOL		
7275	1/4 – 7/8	30	40	70	30	50	45	25	50	60	25	45	40
9283	1/2 – 1	40	43	85	33	55	50	35	60	75	35	50	45
9974	1/2 – 1	35	45	75	30	47	40	25	20	50	28	45	42
10352	1 – 1 5/8	23	50	85	25	38	60	25	45	60	30	36	41
12373	1 – 1 5/8	20	45	70	20	30	55	25	40	70	25	30	57
		BRASS	SAE X1112	SAE 3312	BRASS	SAE X1112	SAE 3312	BRASS	SAE X1112	SAE 3312	BRASS	SAE X1112	SAE 3312
		MATERIAL											

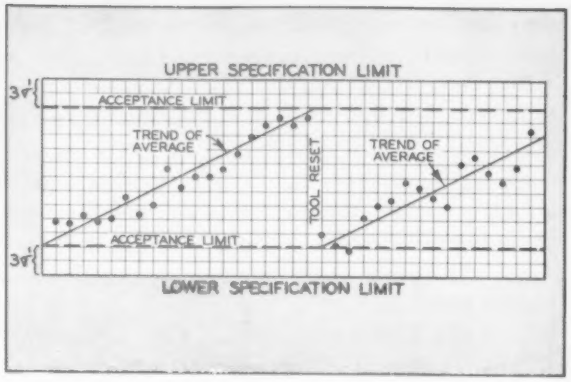

Fig. 3. Control chart to indicate tool wear.

that they do show analysis of operator performance. The same results cannot be expected from all operators on the same machine.

Estimating Tool Wear

Tool wear is actually an assignable cause of error but normally must be tolerated in a process, within limits, for economic reasons. If tool wear is appreciable, specification limits for the dimension produced must be corrsepondingly broader than the natural $\overline{\overline{X}} \pm 3\triangle'$ limits of the variation in the dimension resulting from chance causes. Uniform tool wear results in a trend of the points plotted on the $\overline{X}$ chart along a slope representative of the rate of wear. A representation of this effect is presented in Fig. 3. The $\overline{X}$ points are allowed to vary between *acceptance limits* which are set at distances of $3\triangle'$ inside of the specification limits. Here $\triangle'$ is the estimated standard deviation of the process when subjected only to the chance causes (without the effect of tool wear) and is approximated from $\triangle'$ or $\overline{R}$ in the way described in Part III. As long as the system of chance cause remains unchanged, $\overline{X}$ points within the acceptance limits indicate a state of production confined, as far as $\pm 3\triangle'$ limits are concerned, within the specification limits. When the trend carries the points to the upper acceptance limit, the tool must be readjusted, preferably to the lower acceptance limit which promotes the full utilization of the allowable range and tends to reduce the frequency of occurrence of resettings.

In setting up a control chart to reflect tool wear, it is helpful to know the direction in which the dimensions should recede. Also, the groups should be selected at random intervals if they are to portray a trustworthy trend. The items in each sub-group should be produced in succession so as to be affected as little as possible among themselves by tool wear.

Inclined lines like those in Fig. 2, representing the shifting average, may be fitted to a series of points by sight or by more refined methods of curve fitting described in statistical texts. Control limits

are sometimes computed and represented by lines drawn parallel to the average trend lines.

Tool wear which does not affect the basic cutting action normally has little effect upon the dispersion of a sub-group. On the other hand, tool wear that progresses to dullness results in a decided change in cutting action. Cutting forces and deflection increase and may fluctuate violently. Under such conditions the control chart may be expected to show marked reactions.

Example 2. The control chart of Fig. 3, showing an actual study of tool wear, has been furnished by J. Manuele, director of industrial quality control at Westinghouse Electric Corp., Pittsburgh, Pa. In the study represented by Fig. 4, $\triangle'$ was estimated from a frequency distribution of a group of parts selected before the chart was begun. It was found that $\triangle'$ was about 0.0002 in. The specification limits were 0.1250 and 0.1220 in. The upper acceptance limit was placed a distance of $3\triangle^1$ below the upper specification limit. That is, 0.1250-0.0006=0.1244 in. The lower specification limit was placed at a distance $3\triangle'$ above the lower specification limit. That is $0.1220 + 0.0006 = 0.1226$ in.

Sub-groups of five pieces each were taken hourly, starting at 9 P.M. A figure for $\overline{X}$ was not computed for any sub-group, but the five measurements for each sub-group were plotted on a vertical line. Approximate trend lines for X and $\triangle'$ limits have been superimposed on the plotted points. Strictly speaking, this is not a control chart, but it does give a clear picture of the events which took place.

The numbered notes tell about important events. For instance, at 6 P.M. on the second day (note 3) the plotted points showed an average near the high acceptance limit. The box tool was adjusted, but the rate of rise of the trend indicated a rapidly dulling tool. Consequently, at 12:00 midnight the tool was removed and reset. Other troubles prevented satisfactory performance, and it was not until about 10:00 A.M. that satisfactory progress was resumed. After that a uniform increase in the dimension took place during a 20-hour period.

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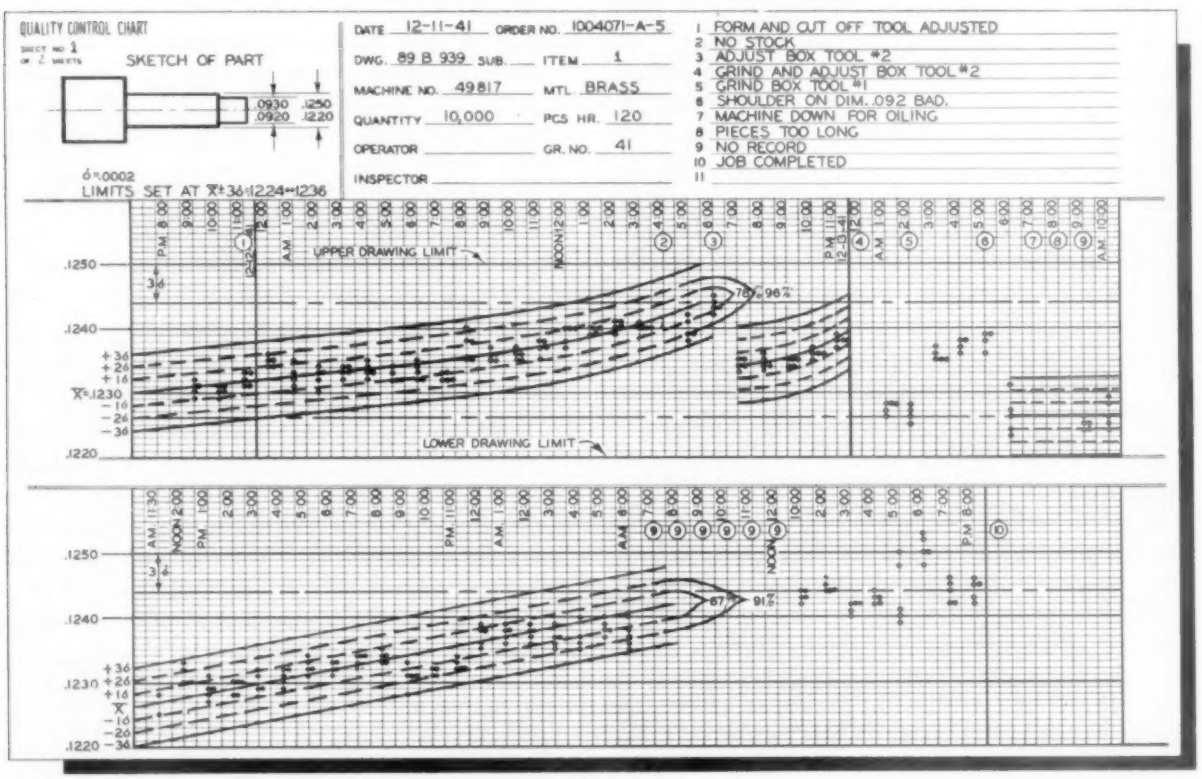
The author wishes to acknowledge the valuable suggestions and criticisms of these articles, made by Mr. Anthony R. Konecny of the University of Illinois.

Fig. 4. The control chart shown here was set up to record hourly the variation in tool wear.



Check List on Tool Planning and Design

By Maurice Conklin

Features

(1) Location
(2) Support
(3) Retention
(4) Tool Guidance and Control
(5) Economy
(6) Good-Housekeeping
(7) Safety
(8) Ease of Use

1. Location

Is it duplicating?
Will it facilitate and permit working to drawing tolerances?
Is it correct for end usage of part?
Are locators easily kept free of dirt and chips?
Does the location tie in with other operations?

2. Support

Is it adequate?
Properly located?
If adjustable, is it convenient and reliable?
Is the body of the tool sufficiently rigid?

3. Retention

Do clamps hit work?
Are they needed?—and if needed, are they adequate?

4. Tool Guidance and Control

Should a pilot be provided?
If there is a pilot are dirt grooves required?
Should a guide bushing be used?
Should a setting block be used?
If tool should enter work to only a certain depth is provision made for positive stoppage at the desired point?
Might chips interfere with proper stoppage?

5. Economy

Is carbide used for cutting edges where suitable?
Is tool easy to load, clamp, unload etc.?
Are surfaces hardened where they should be?
Have replaceable parts been provided in sections where wear will be severe?
Are standard parts, std. bushing, etc. used as much as possible?
Are operations combined as much as possible?
Consistent with reasonable cost of tool, are as many parts as possible, done at once?

5. Economy (cont'd.)

Are single point cutters used wherever suitable? (a cutting head with 6 duplicate cutting bits might do same job with only one).

If a cutting tool has it been designed with a maximum number of resharpenings in mind?

Would a standard tool slightly altered be preferable to a special tool? E.g. a .993 reamer can be made from a 1″ standard reamer or a stock carbide tool might be reground to provide a form tool.

Are welds made using buckshee fillets where practical? *

Is welding limited to that necessary?

Are finished pads, buttons and raised parts used in place of finishing large surfaces?

Is finished stock used, wherever it will reduce the number of operations in producing the tool without introducing warpage? (Cold rolled or drawn will warp after machining under some circumstances.)

Are finishing and grinding omitted where not required or desirable?

Is tool easily handled if it must be moved about or turned over during use?

Can chips and dirt be cleared quickly?

6. Good Housekeeping

Are all unnecessary parts eliminated?
Is coolant run through channels?
Is tool in good state of repair?

7. Safety

Will tool fall over easily, loaded, unloaded or as a result of operation?

Are cutters likely to strike tool?
If a drill jig, will it spin around easily if cutter binds?
If shank (as chisel) is to be hammered, is it heat treated tough, so it will not shatter, and is edge chamfered to avoid mushrooming?

Are dangerous sharp corners removed?
If a trunnioned tool, is it balanced so it will not flop over suddenly?

8. Ease of Use

Should pipe be used, holes be cut or other material removed to make it lighter?

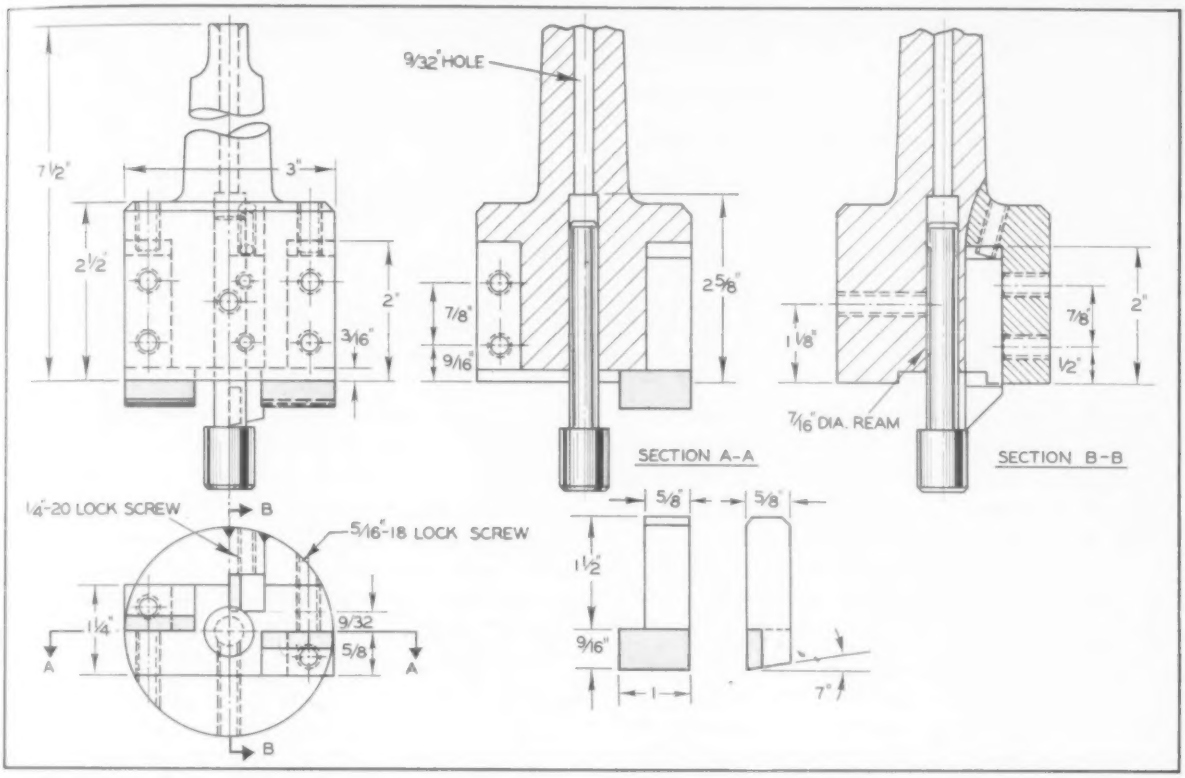
Do all levers operate easily?
Do all pins, bushings and other sliding members move freely?
Should tapered leads be provided on locators, etc.?
Will hand knobs, thumb nuts, etc. turn easily even if oily?

* Where two pieces join at right angles, if one overhangs the other, a fillet weld may be used in the angle, thus avoiding edge beveling operation otherwise often required.

Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Combination Spotfacer and Chamfering Tool



The combination spotfacer and chamfering tool, here shown, is adaptable to a wide variety of work, including fly cutting. Blades may be interchangeable to provide different angles and rakes.

The combination spotfacer and chamfering tool, here shown, is comparatively simple and easy to make and maintain. The body, which should preferably be hardened, with the shank ground, can be modified to suit particular job requirements. As shown, the chamfering cutter is a standard ½ in. square tool bit, and the spotfacer blades are tipped with standard carbide blanks. When the carbide tips are worn down, or broken, there is no need to grind half the cutter as in the case of solid carbide spotfacers. Just replace the blade with a reserve.

The tool shown may be used as a spotfacer alone by merely removing the chamfering tool, and different rakes and angles can be obtained by using other suitable interchangeable blades. Fly cutting can also be done with this tool at speeds suited to the material.

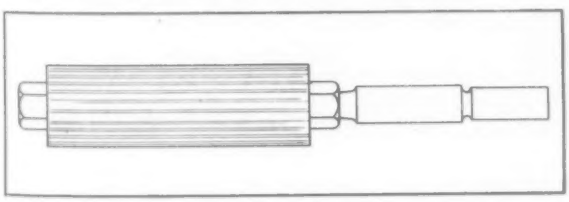
George J. Whitley
Philadelphia, Pa.

Grip for Plug Gages

Small plug gages equipped with tapered-socket handles, of the type shown, usally become somewhat tiresome to handle on production work because the handle is too square for comfortable grasp. The gage can be used much faster and more accurately if a piece of corrugated rubber hose is slipped over the handle.

Frank M. Butrick, Jr.
Chapter 38, ASTE

Rubber hose provides grip for small gages!



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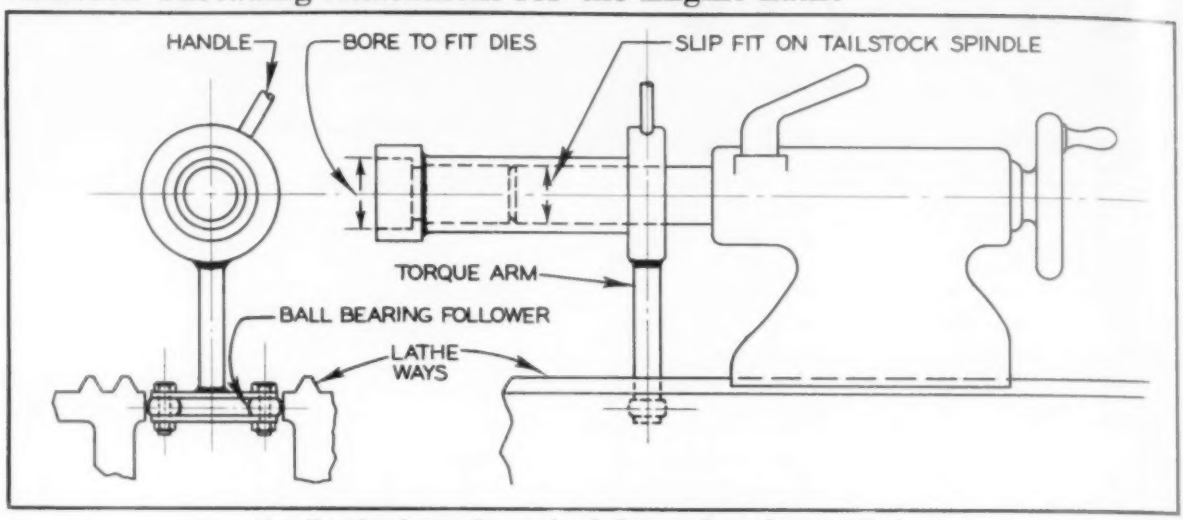
Tailstock Threading Attachment for the Engine Lathe



A tailstock adapter for engine lathes, such as shown, will simplify threading and may further be adapted to other operations.

Axially true threads can be quickly die-cut on an engine lathe with a sliding, self-feeding die holder, such as illustrated. Primarily designed to slip over the tailstock spindle, the principle can be varied to produce other end results. If used for long production runs, it were well to provide a substitute tailstock spindle, to save wear on the original.

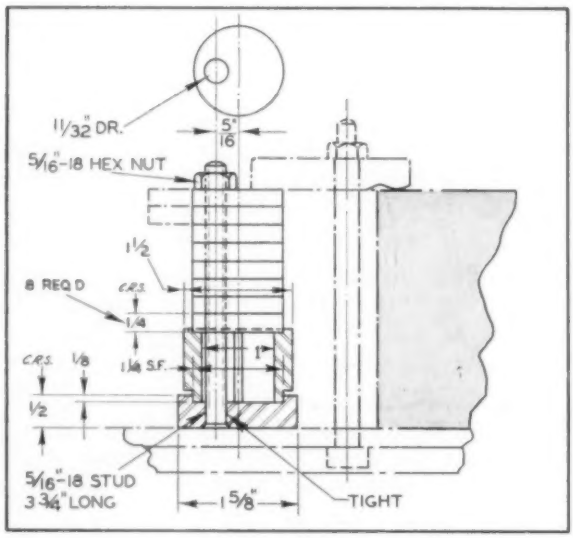
The die holder slips over the tailstock spindle, with torque taken up by an outrigger torque arm. Ball bearings, mounted on the arm, provide for easy roll between the bed ways. A reasonable clearance—say about 1/16 in.—between the rollers and the bed ways will obviate any drag from chips or other foreign matter. The head of the holder should be large enough to accommodate the largest threading dies which may be used, whether button, die stock or other type. Any variations in outside diameter can be compensated for by means of adapters.

To cut a thread, simply push the holder up to the work and apply hand pressure to start the die into the cut. The die will then feed itself, but length of thread must be determined and the lathe reversed at the desired point. For heavy threading that might present a hard start, clamp the tailstock to the bed and start the thread with a turn or two of the tailstock spindle. The holder will then slide freely back on the spindle on reversing the lathe.

The holder can be further applied to tapping, hollow milling, knurling, light spotfacing or grooving, while combination drilling and threading operations are possible provided that the drill is smaller than the die opening. The holder can be locked to the spindle, if desired, using a lock such as suggested in the inset.

Arthur R. Christensen
Lockport, N. Y.

Addition to Adjustable Height Block



A further improvement is suggested for the adjustable height blocks originally submitted by Mr. J. P. Paquin and later expanded on by Mr. L. M. Lepsoe.* The suggested improvement mainly consists of a split extension, as shown in the drawing.

As will be noted, the split extension facilitates quick removal of the same, thereby causing the washers to drop into the nest to allow for shallow clamping arrangement.

J. D'Angelo
Greensboro, N. C.

As a further improvement to the adjustable height blocks, a split extension, as shown at left, permits its quick removal.

* The Tool Engineer, August '49 and August '50 issues.

Tool Engineering Report No. 3

The Extrusion of Soft Metals—Principles and Applications

By Andrew E. Rylander

TERSELY DESCRIBED, the extrusion process consists of forcing cold, plastic or hot metals or materials, under high pressure and through suitably shaped dies, to produce comparatively short or continuous shapes. The pressure medium may be air, fluid or mechanical, or a combination of these. As homely examples of simple extrusion devices may be cited the pressure grease gun and the meat grinder, the latter employing a worm as the pressure medium.

The four methods commonly applied to industrial extrusion are slow pressure; direct; indirect; and impact. Slow pressure is employed for doughy, plastic or pasty materials in either a cold or warm state; direct and indirect for either cold or hot work, depending on the material; while impact extrusion—which embraces direct and indirect—is usually employed for cold working of softer materials such as lead and aluminum. Of late, it has been used for cold extrusion of steel.

In most cases, the material to be extruded is forced through a die by a punch or plunger; sometimes, however, the die is mounted on a hollow ram and pushed through the billet or slug instead of the latter being pushed through the die. This is known as indirect or inverted extrusion and is merely supplementary to and not distinct from the four methods mentioned above, all of which will be described and illustrated in some detail. Fig. 1 shows a machine used for slow pressure extrusion, while Fig. 2—a schematic diagram—shows the principles of direct and indirect extrusion.

In this connection, it may be pointed out that all of the line drawings used to illustrate this report are designed to show operating principles; they are, however, closely true to their particular applications and actual design details would vary only with the material being extruded and the shape to be produced.

Extrusian of Plastics

As differentiated from the impact method, the slow pressure method may be used for extrusion of dough in bakeries; for extrusion of ceramic products, chalk, and graphite rods such as used in lead pencils; for rubber covering of insulated wire and cable; for manufacture of rubber or plastics tubing and hose; for manufacture of lead tubing and pipe; for extrusion of powder metal shapes, such as pinion rod; and for various extruded products in the plastics industry.

The plastics extruder shown in Fig. 1 is a compounder-extruder designed to combine the compounding and extrusion of thermoplastics in the one machine. The various com-

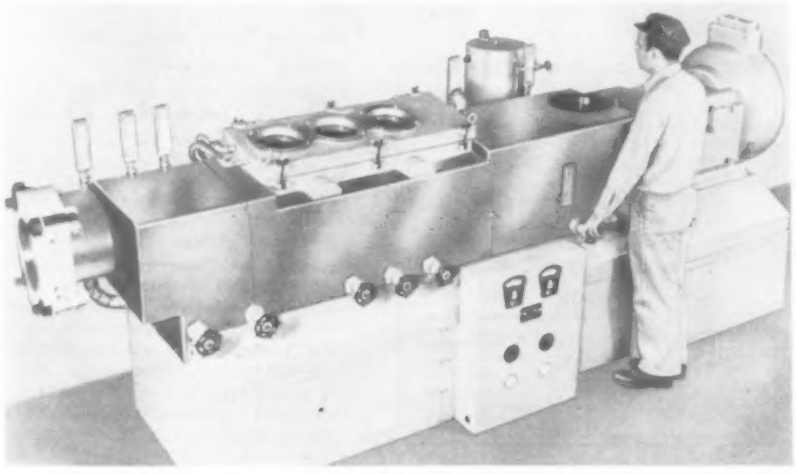


Fig. 1, a worm-drive compounder-extruder, such as used in the plastics industry to combine compounding of thermoplastics with extrusion of pellets or finished shaped. Operation is mainly automatic.

ponent ingredients are proportioned and dumped into the several hoppers, then mixed and kneaded under high pressure and elevated temperatures, and finally extruded as a finished shape or as pellets subject to further processing. This machine employs worms as the pressure media, and the entire cycle of operations—compounding and extrusion—is mainly automatic.

The extruding machines used for rubber covering of insulated wire also operate by worm pressure. The reason for the choice of a worm over direct pressure—as with a hydraulic ram—may be more readily understood from the following description of rubber processing:

The rubber is first compounded—latex, shoddy, sulphur and so on in proportionate quantities—and then mixed, put through a masticator, next strained to exclude metallic and other foreign substances, and then milled between heated rolls of a rubber mill, from which it emerges in sheet form. While still hot from the milling, the sheet is cut into strips—or, for easier handling, diced—and then fed into the tuber. Because the rubber is fed in chunks, the tuber worm tends to knead it into a homogenous mass, thus precluding the possibility of inclusions of cracks in the extruded rubber covering.

As indicated by the section through the tuber chamber, Fig. 3, the wire—single or stranded, bare or taped—is threaded through a bushing in the heel of the chamber. The I.D. of this bushing coincides with the O.D. of the wire so as to exclude escape of the rubber due to back pressure. It is next threaded through the die, the I.D. of which determines the O.D. of the insulation as well as its wall thickness.

As the wire is pulled through the tuber by a pullout sheave, rubber is forced through the die while, at the same time, it is pressed tightly onto the wire and, if stranded, well into the interstices. After tubing, and during pullout, it is dusted with talcum powder to prevent adhesion. The rubber covering is then vulcanized.

Extrusion of Rubber Tubing

The same method is used for extrusion of rubber tubing and hose, about the only difference being that the heel of the tuber chamber is either plugged or left solid, and that the die is supplemented by a core plug which determines the I.D. of the product. This is schematically shown in Fig. 4—a section through a lead press, of which more later—and also in Fig. 5, the latter showing an alternate method of chambering a tuber or a lead press cavity.

While the rate of pullout must be proportionate to the feed of the rubber, as it emerges from the die, for both insulation of wire and extrusion of rubber tubing, it is important that extrusion—pullout ratio be more closely synchronized for the latter process. The reason is that, since the rubber tubing is not reinforced with a core wire, it could stretch and so lose size if pullout rate were too fast for a given rate of extrusion. As for that, however, the rubber is usually under such pressure that, within reasonable variations in pullout speed, one may be assured of an adequate rate of feed.

Several passes may be required when manufacturing rubber hose having braided reinforcements or laminations. First, the inner rubber tube or lamination is extruded as outlined above; that is, the O.D. and I.D. are sized by the die and core plug, respectively. This is then covered with braid which, in turn, is rubber covered, and so on for the required number of plies. From here on, however, one proceeds as in the case of the rubber covered wire since, after the initial braid and for each succeeding lamination, the hose must be first threaded through the bushing and then through the die.

An idea of the units required for rubber tubing may be had from the diagram, Fig. 6, which shows a typical layout for wire insulation. The bare wire is uncoiled from a take-off reel, then threaded through the tuber; then, as it emerges covered with rubber, is passed through a talc box to prevent adhesion, wound around a pullout sheave—which determines the feed rate—and then wound up on a take-up reel. Practically the same procedure would apply to rubber hose; however, the take-off reel would be omitted when extruding tubing.

Direct Pressure Extrusion

While the extrusion of rubber and certain thermo-plastics prompt a choice of the worm as the pressure medium, for the reasons stated, certain other materials—as, for example, clay for ceramic products, chalk, graphite and puddled lead—may be more readily extruded by direct pressure such as exerted by a hydraulic ram. Here, except that the equipment is on a grander scale, we apply

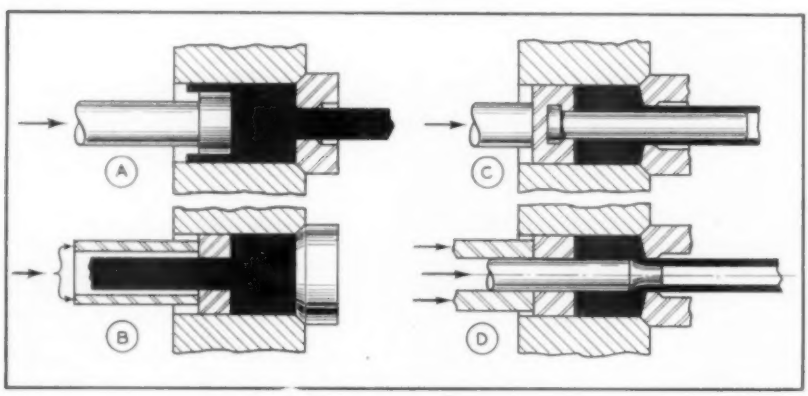


Fig. 2, a diagrammatic sketch showing the principles of (a) direct sleeve extrusion of a rod or shape; (b) indirect extrusion; (c) extrusion of a hollow billet; and (d) extrusion of a tube from a hollow billet. These sketches are elaborated on in following illustrations.

the simple principle of the pressure grease gun. The nozzle would be replaced by a die which, except that it might be in direct line with the force of pressure for certain applications, would compare in general design with those shown in Figs. 4 and 5.

One reason for resort to direct pressure is that the extrusion unit may be more readily dismantled for cleaning, a consideration of some moment in the case of abrasive materials which might be forced into bearings and which would further tend to erode rotating mechanisms. Another consideration is that cylinders and rams may be reconditioned at a considerably lesser cost, as compared to the worm.

Extrusion of Lead

Essentially, there is not much difference between the extrusion of rubber and plastics, as described above, and the extrusion of lead pipe. Both are extruded under slow pressure. Where, however, the rubber or plastics extruder usually but not always employes a worm as the pressure medium, lead extrusion is invariably done with hydraulic pressure, as shown in Fig. 4. Incidentally, it may be explained that the chamber of this lead extruder, as drawn, is entirely disproportionate to the area of the cylinder, here shown greatly reduced due to space limitations. However, the drawing adequately illustrates the general principles and construction of a lead extruder.

Essentially—and as indicated by the drawing—the extruder consists of a cylinder, a ram, a chamber, a die and a core plug. As in the case of rubber or plastics extrusion, the die establishes the O.D. of the extrusion while the core plug determines the I.D. The same variation of installing the core plug, as shown in Fig. 5, would apply to the lead extruder. The principle is the same.

After being melted in a adjacent lead pot, the lead is poured into the cylinder with the ram up, the die opening being temporarily plugged to prevent escape of the molten lead —that is, for the initial start. Here, the term "molten" is a misnomer since the lead is actually maintained in a puddled state under close temperature control. On emerging from the die under pressure of the descending ram, then, it immediately coalesces and may so be wound up on a reel without danger of collapse or distortion.

Whereas, in rubber tubing, the rate of feed is largely determined by the speed of the pullout sheave, the feed rate in extrusion of lead pipe is entirely governed by the speed of the descending ram and must not exceed the time interval required for coalescence. Consequently, the take-up reel must be closely synchronized with the rate of extrusion; furthermore, take-up must be progressively slowed as the diameter of the reeled-up coil increases. This may be done with an infinitely variable speed drive although it is more or less general practice to drive the reel through a slip-clutch or a slipping belt.

Practically the same procedure would be employed for lead sheathing of electrical cable, with the exception that the cable would first be threaded through a bushing as shown in Fig. 3. However, the rate of extrusion would be governed by the speed of the ram, not by a pullout, and outside of the extrusion press itself, and the lead pot, the only auxiliary units required would be the take-off and take-up, as described above and further outlined in the diagram, Fig. 6.

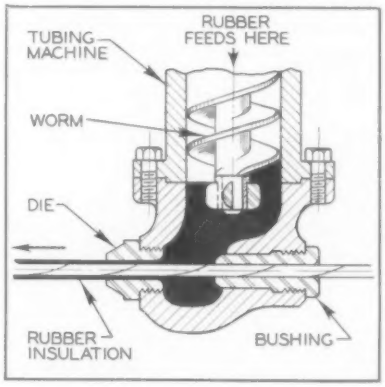
Impact Extrusion

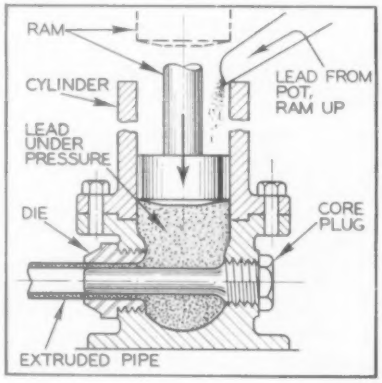
Impact extrusion offers one of the fastest and most economical means of producing cups, shells, round or asymmetrical tubes or shapes. The extrusion is produced from a relatively thick disc, slug, or billet which, placed in a die, is then struck sharply by a punch. The force of impact then causes the metal to flow through the die, or backward along the punch, depending on whether the extrusion is direct or inverted. The entire movement of metal takes place in a fraction of a second, usually producing a shape devoid of flaws or inclusions.

Impact extrusion is usually but not always done on a single-action press, either vertical or horizontal, and at present stage of development is mainly confined to the softer metals such as lead, tin-alloyed lead, aluminum and, to some extent, copper. However, the process has latterly been applied to cold extrusion of steel and at tremendous savings

Fig. 3, at left, a section through the chamber of a worm-drive rubber tuber. The bare wire is threaded through bushing in the heel of the chamber, then through the die, the I.D. of which determines the O.D. of the rubber covering.

Fig. 4, at right, a section through the chamber of a lead extruder which, in principle, coincides with the operation of the rubber tuber except that pressure is exerted by a hydraulic ram. The difference between the I.D. of the die and the O.D. of the core plug determines the wall thickness of the extrusion.





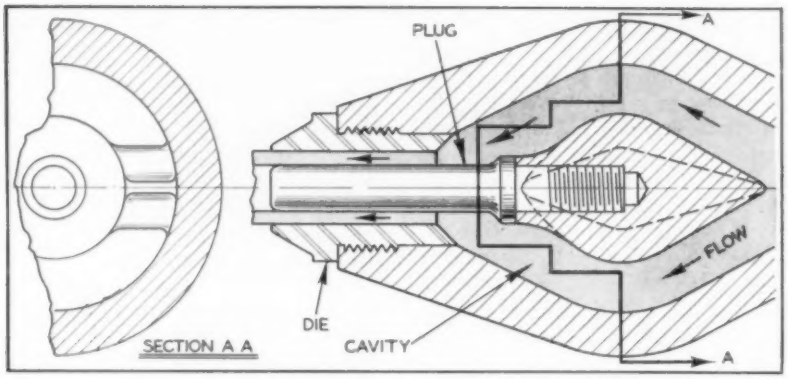


Fig. 5, a cross section showing an alternate design for the chambers illustrated in Figs. 3 and 4. Here, the core plug is inserted in a "bridge" which, spanning the chamber, provides for easy flow of the material being extruded.

in time and material over previous methods for such items as the manufacture of H.E. shells. Outside of such late developments, however, usual applications are manufacture of thin-walled tubing and collapsible tubes such as used to contain dentifrices, shaving soap, pharmaceutical jellies and products of a like nature.

Tools for Impact Extrusion

Fig. 7 shows a cross-section through a punch and die assembly such as used for impact extrusion of thin-walled lead tubing having a wall thickness of about 0.006 in. This assembly consists of a die shoe, a die, a punch which also incorporates a pilot or mandrel, and a punch holder. Indicated but not shown in detail is a chute for feeding the slugs from a magazine. For this particular job—a tube $\frac{5}{8}$ in. O.D.—the machine used was a single-action, crank driven horizontal press of 35 tons rated capacity—rather below the safe rating as the job strained the press to its limit.

Dies and punches for impact extrusion must be made of the highest grade die steel, heat-treated for both extreme toughness and hardness, and adequately backed to withstand the shock of impact. Also, the surfaces must be highly polished and devoid of even the most minute flaws or scratches, while dimensional tolerances must be held well within 0.0001 in. as the punches and dies are originally produced.

There is reason for this accuracy. Assume a wall thickness of 0.005 in., and further assuming that the punch and die were orginally made 0.001 in. undersize or oversize, respectively, then the actual increase in wall thickness would amount to 20 percent, with a commensurate boost in cost of material. In mass production runs, this might easily spell the difference between profit and loss. Therefore, close dimensional tolerance of tooling hold for practically all extruded metallic end products as a "must" toward manufacturing economy.

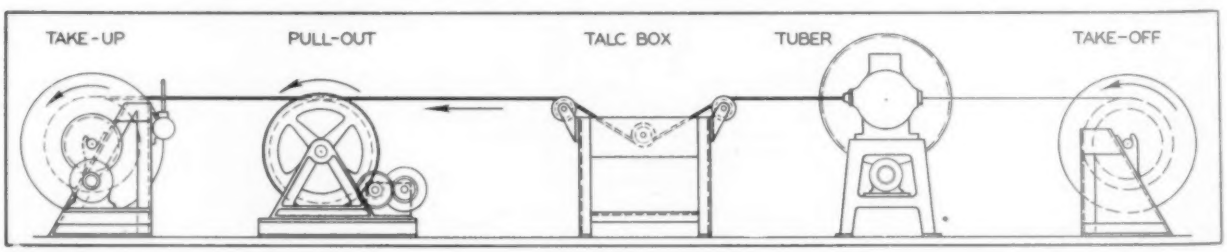
In extruding thin-walled tubing such as here discussed, a pierced slug is magazine fed in line with the die, as outlined above. As the ram advances, the pilot punch enters the hole in the slug, centering it; then, the punch pushes the slug into the die and, with the simultaneous impact, literally "whips" it through the thin annular opening between the die and the pilot, the latter acting as a mandrel or sizer for the I.D. For a rough estimate of volume, a slug $1\text{-}\frac{1}{4}$ in. in diameter X $\frac{5}{8}$ in. thick, and having a $\frac{5}{8}$ in. hole, would produce a tube about 8 ft. long with a wall thickness of 0.005 in.

Close Mating Neessary

As the press runs continuously—80 or more strokes per minute—and is subject only to interruptions in magazine loading, some care must be taken lest the extruded tubes accordion as a result of striking some obstruction. For this reason, they are usually deposited on a bed of stretched canvas. To insure extrusion of all the metal in the slug, the ram should be adjusted so that the punch closes against the die just over dead center of the press crank.

To further insure complete extrusion, and also to facilitate flow of metal as well as to preclude escape of metal between the punch and

Fig. 6, a layout showing rubber covering of insulated wire and cable from take-off to take-up. The bare wire, unspooled from the take-off, passes through the tuber for rubber covering, then through a talcum box, to prevent adhesion. Feed rate is determined by the pullout, and the wire is then reeled up on a take-up stand.



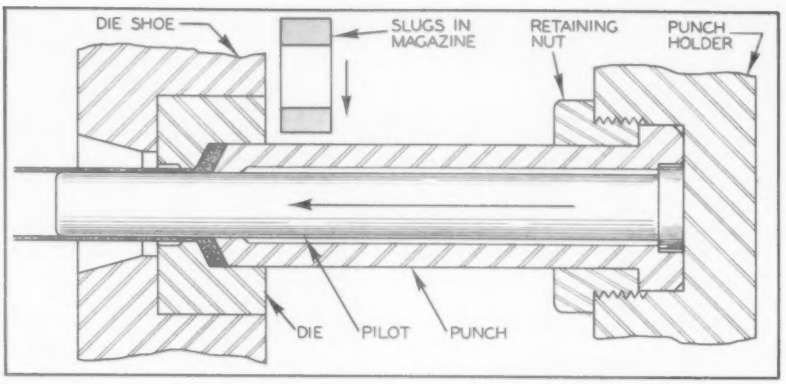


Fig. 7, a cross-section showing principles of operation for extrusion of thin-walled lead tubing by the impact method. The slugs, magazine fed from a hopper, drop into place ahead of the die. On advance of the ram, the impact of the punch against the die renders the slug plastic, when the lead flows—"whips", rather—between the pilot punch and die.

die due to back pressure, it is essential that the die and punch be closely mated. The die bottom is made slightly conical—say about 130 deg included angle—and the end of the punch is machined to a corresponding angle. The punch is made slip fit in the die, or with just enough clearance to prevent bind when the components warm up.

With the die set shut, then, abutting surfaces should be in complete contact and the diametral fit such as to exclude rearward escape of metal—that is, for direct extrusion. These recommendations are general rather than arbitrary since both angular and diametral dimensions would vary somewhat for different metals and applications.

Collapsible Tubes

Fig. 9 illustrates the conventional method for impact extrusion of collapsible tubes. Here, the die is blind and the flow of metal reversed, being upward around the punch. A teat on the punch, and another on a plug inset in the die, serve to indent the thin section of the nozzle, which is later pierced through by the consumer. The knockout holes in the die shoe are for the purpose of pressing out the die.

While the threading of the stem for the screwed-on cap could possibly be done simultaneously, this would involve a rather complicated self-opening die with the further complication of the metal being forced into the joint, entailing recurrent cleaning. Hence, the threading is more economically done in a second operation. Products such as this are usually extruded in a vertical press, the slugs being fed from a hopper. A typical press setup for work of this nature is shown in Fig. 10.

Here, as in the case of extruding thin-walled tubing, close dimensional tolerances are necessary between the punch and die so as to maintain the wall thickness. However, the thickness of the head end—usually 0.010 to 0.040 in. thicker than the side walls—is controlled by adjusting the press ram, and the tube is immediately trimmed and the scrap remelted.

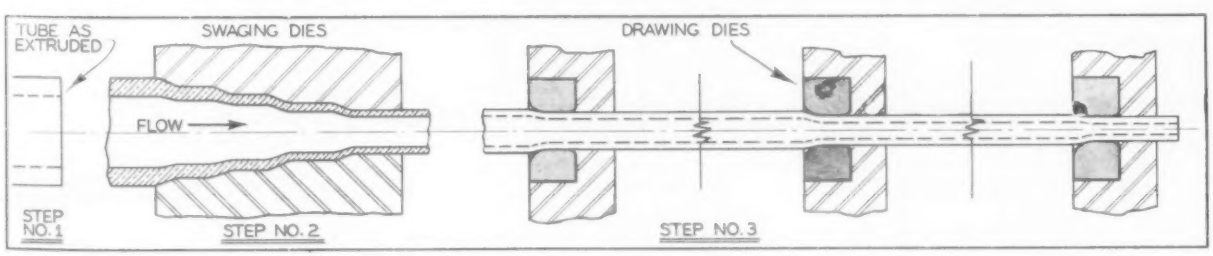
Due to the thin wall section, and further complicated by the fact that the extruded tube clings to the punch and is carried upward with the up-stroke of the ram, stripping of collapsible tubes presents something of a problem. While this is less acute with the stiffer aluminum alloys, stripping of lead of lead-tin alloy tubes may tax the ingenuity of the die designer. Outside of direct stripping—the more common practice—the tube may be grasped with retractable fingers as the ram ascends and then flipped clear of the die.

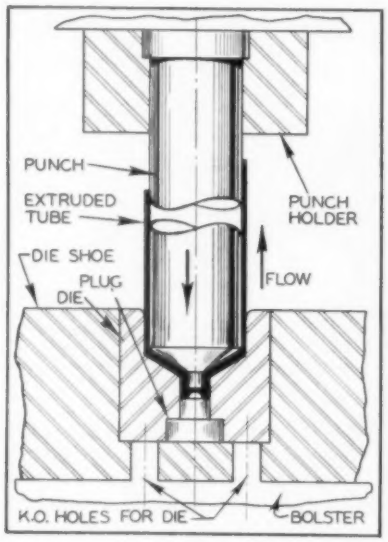
Extrusion of Copper

The impact method may also be used for the extrusion of copper although, as in the case of the thin-walled tubing previously described, it is suitable only for comparatively short lengths or as much as can be impact-extruded from a comparatively small slug. Such applications are rather limited. As another consideration, the tonnage rating of the press must be much higher to withstand the shock imposed by the comparatively harder material.

On a closely comparable tonnage rating, however, one may extrude a short length of copper tube from a

Fig. 8, showing the development of extruded copper tubing. A slug, pre-pierced as shown in Fig. 7, is first extruded into a short tube, as indicated by Step 1. This is further reduced by swaging—Step 2—and then drawn through dies in a draw bench for final sizing, Step 3.





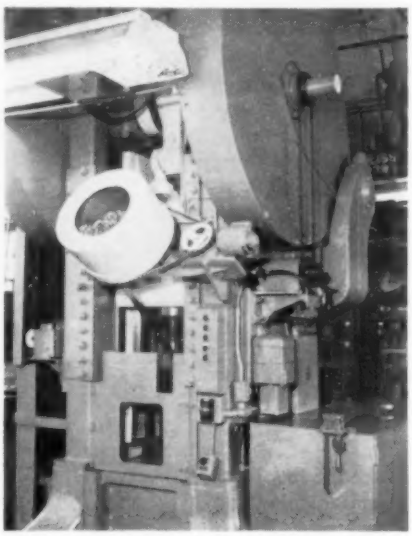


Fig. 9, at left, showing the tooling for impact extrusion of collapsible tubes. The solid slug, which is magazine fed, drops into the die; then, on impact of the descending punch, the metal flows upward around the punch to form the wall after the manner of extruding the lead tube described in Fig. 7.

Fig. 10, at left, a press setup for impact extrusion and trimming of collapsible tubes. Note the "good housekeeping".

pre-heated slug, the tooling being similar to that shown in Fig. 7. Then, as schematically shown in Fig. 8, the tube so extruded may be further reduced by swaging as an intermediary operation to drawing on a draw bench. The swaging operation serves the dual purpose of reducing the O.D. of the extruded tube, and consequently lengthening it, so that it may be threaded into the drawing dies.

Assuming, for easy reckoning, a slug 2 in. diameter X 1 in. long and having a $\frac{3}{8}$ in. hole, the cubic contents of which would be 3.031 in., one could then extrude a tube $\frac{1}{2}$ in. O.D. X $\frac{1}{32}$ in. wall X 36 in. long. In turn, this tube could be drawn to a small diameter with a commensurate increase in length. All this, of course, is purely illustrative, and in this connection it may be explained that the cross-section drawing of the swaging die, Fig. 8, is a composite since several dies might be required to effect the necessary reduction.

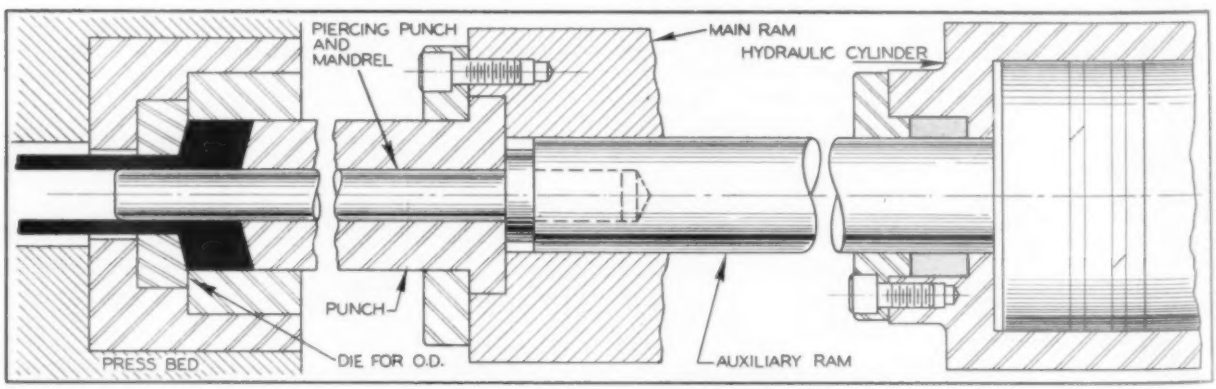
Simultaneous Piercing

When impact-extruding metallic tubing, it is necessary that the slug be either pre-pierced, as indicated in Fig. 7, or that piercing be simultaneous with the extrusion. A tool setup that combines piercing with extrusion is shown in Fig. 11. Such an operation would require a double-action press, with the piercing punch carried on an auxiliary ram and the extrusion punch mounted in the main ram.

The auxiliary starts ahead of the main ram, so that the piercing punch contacts the slug first and pushes it into the die, which in this case is made somewhat deeper than a die for a pre-pierced slug. As the slug bottoms in the die, the piercing punch pushes through to punch the hole; then, on simultaneous impact by the extrusion punch, serves as a mandrel to size the I.D. of the tubing.

While a fairly clear idea of the method may be had from the line drawing, Fig. 11, it may be explained that the hydraulic cylinder is sketched in to indicate the double action rather than as a detail of design. For the purpose of the job, a crank-driven or hydraulic double-action press would be the logical choice. The tools would then be in-

Fig. 11, showing tooling for extrusion of tubes or hollow shapes. The slug is first pierced by a pilot-piercing punch, carried by an auxiliary ram, then extruded by impact pressure exerted by the main ram. During extrusion, the pilot punch acts as mandrel to size the I.D.



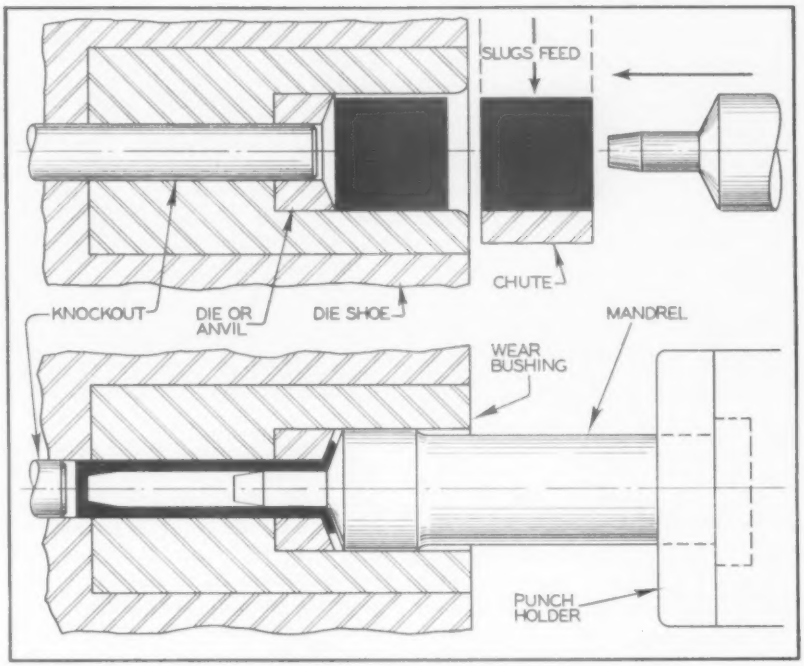


Fig. 12, showing extrusion of shells. The slug is solid, and is pushed into the die by the pilot on the punch, which also serves as a mandrel for sizing the I.D. Extrusion is effected by the main body of the punch, and the shell is ejected by a knockout. A flash is left for subsequent trimming.

stalled vertically instead of horizontally, as shown; however, the principle would be the same regardless of mounting.

In all of the foregoing examples of impact extrusion as applied to manufacture of tubes hollow all the way through, the punch abuts tightly against the bottom of the die on closing, and all of the metal is extruded as a result of this closure and the speed of impact—that, is, the extruded shape is "whipped" clear of the die.

Closed-end Shells

When, however, it is desired to extrude shells having closed ends, as shown in Fig. 12, then the slug is pierced only part-way, leaving a head which is later trimmed off. The shell is pushed back through the die by means of a knock-out. Here, a single-action press is used, and the pilot punch—which only indents the slug—is integral with the main body of the punch although, where diameters permit, it may be inset into the punch. However, there is no particular advantage in such construction since wear would be about the same on both parts.

This illustration shows the "before and after" of the extrusion cycle, omitting actual knockout. As in the case of the tooling shown in Fig. 11, the die here is shown installed in combinations with a wear bushing—properly called a container—which also acts as a backing for the die. Also, the die is made comparatively deeper, to allow full entry of the slug before partial piercing, and incorporates a rounded or chamfered lead-in. It is also essential that the feed chute be located close to the die, and that the slug is in line with the die opening, so that it may push straight in without cocking.

The length of the pilot punch must be closely proportioned to the thickness of the slug; for one thing, so that it will not pierce through, and for another, so that the solid end of the extruded shell be held close to desired thickness. Here, however, the knockout serves as an anvil during initial impact of the pilot, and recedes as the latter advances so as to maintain a square end on the shell.

As the ram retracts, the knockout follows with the return stroke to eject the shell and remains in advanced position pending the next power stroke. Because the extruded shell must be cleared of the die and the feed chute before the next working stroke, the feed chute must be provided with an escapement so that the following slug cannot drop into position during ejection.

There must also be sufficient pause between working strokes to allow time for ejection; consequently, the extrusion of headed shells does not readily lend itself to continuous operation of the press. This doesn't necessarily mean that the operator

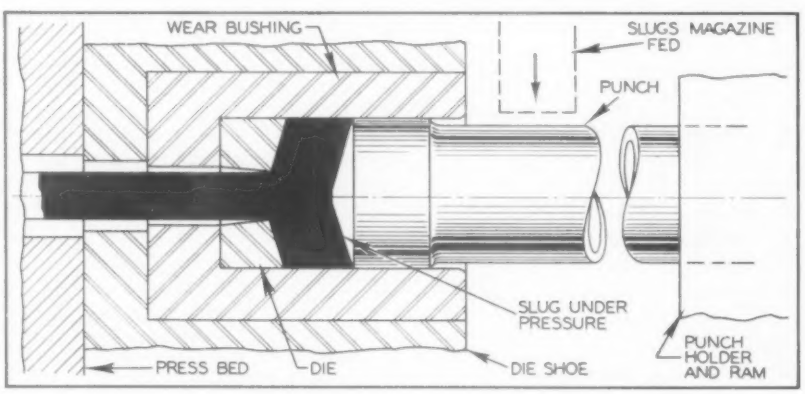


Fig. 13, showing the extrusion of solid shapes. The tooling is similar to that for tubes except that the pilot is omitted. The extrusion may be whipped clear through the die or left with a head, as in Fig. 12, which is later trimmed off.

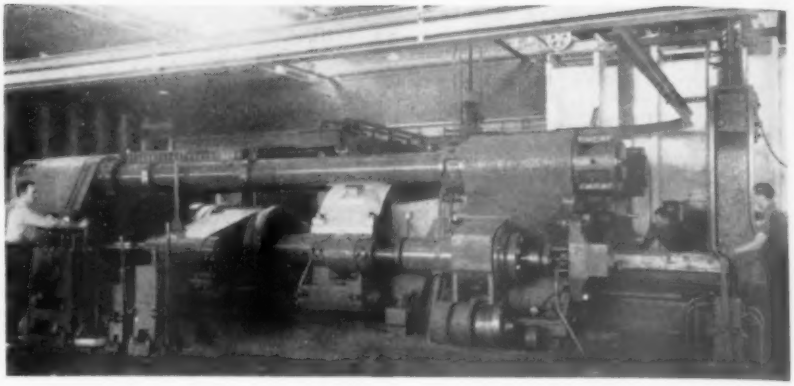


Fig. 14, showing one of the large horizontal hydraulic presses used for extrusion of aluminum shapes. The billet is preheated and extruded under high pressure. Here too, as in the press setup shown in Fig. 10, the keynote is "good housekeeping."

must trip the press for each working stroke since, when so desired, a timer may be installed to provide automatic operation. A number of such devices were shown in the January 1951 Report—*Elements of Automatic Stock Feeds*—which, with variations to suit the job, may well be applied to selective feeding of slugs.

Extrusion of Solid Shapes

In general principle, there is no particular difference between extrusion of tubes or shells, as discussed above, and extrusion of solid shapes, as suggested by Fig. 13. One merely eliminates the pilot punch, the die profile then determining the external shape of the extrusion—round, square, polygonal or as otherwise specified. Depending on the material, the extrusion may be whipped clear through the die or, in some cases, left with a head which is later removed. In the latter case, the die incorporates a knockout which, as shown in Fig. 12, also serves as an anvil to maintain end squareness.

We have so far outlined the general principles of both slow pressure and cold impact extrusion of the softer materials and metals. There are, however, intermediary metals which bridge the extreme between the purely soft and the hard metals such as steel. These include copper—as, for example, the copper extrusion referred to in Fig. 8—and aluminum alloys which, in the larger billets, would require pre-heating for successful extrusion. In such cases, the die set is also pre-heated prior to start of extrusion; from then on, die heat is maintained as result of feeding the pre-heated slugs.

Speed and Pressure

Shown in the table below are extruding pressures for various metals in the softer brackets; in general, however, pressures would run from about 35,000 psi to considerably over the high limit shown in the table. As an indication of extremes, total pressures for cold extrusion of steel would run well over 3000 tons or taking a 4½ in. diameter billet as an example, around 375,000 psi. That requires a rugged press.

The actual speed of extrusion is difficult to define since, with some materials, it may be stated in terms of quantity—pounds per hour—rather than in terms of length. With the impact method, extrusion is practically instantaneous and may therefore be predicated on the strokes per minute of the press—say 80 per minute as for the tubes discussed in connection with Fig. 7.

On the other hand, slow pressure extrusion of rubber and puddled lead might run from 12 to 15 ft. per minute with variations over and under, depending on the diameter of the extrusion. Soft metals range from 6 fpm up, while certain alloys may be extruded at speeds of 800 fpm. Practically the only safe basis for an estimate is a known quantity; given a metal that has previously been extruded from a slug of known size, and speed known, then, that would establish a norm for estimate.

TABLE OF EXTRUDING PRESSURES FOR VARIOUS MATERIALS

MATERIAL	EXTR. G PR., PSI
Soft lead	40,000— 60,000
Copper-bearing leads	44,000— 72,000
Antimonial and tin-bearing alloys	60,000— 90,000
Tin-base alloys	40,000—100,000
Softer copper alloys	30,000 Approx.
Harder copper alloys	Up to 120,000
Aluminum-base alloys	10,000—100,000
Magnesium-base alloys	5,000— 50,000
Zinc-base alloys	100,000—120,000

Bibliography

"Extrusion of Metals", The Tool Engineers Handbook
"The Extrusion of Soft Metals", The Tool Engineer

Credits

Welding Engineers, Inc.
Aluminum Company of America
Aluminum Company of Canada, Ltd.

Cover

This month's cover shows an extrusion press in the Phoenix, Arizona, plant of Reynolds Metal Company.

Another Tool Engineering Report will appear in July issue, *The Tool Engineer*.

Attired in Stetsons and western boots, Ben J. Hazewinkel, national director, and Clinton J. Helton, Denver chapter delegate, cite attractions of 1953 annual meeting town. Right: National officers elected by board of directors are, from left, seated: Leslie B. Bellamy, first vice-president; Jacob J. Demuth, president; standing: William A. Thomas, secretary; Howard C. McMillen, treasurer; Thomas J. Donovan, Jr., third vice-president, and Harry B. Osborn, Jr., assistant secretary-treasurer. Roger F. Waindle, second vice-president, is absent to receive military speakers for mobilization technical know-how conference that opened convention program.

A. S. T. E. NEWS

Doris B. Pratt, Editor

Demuth Wins Presidency At Society's New York Convention

Delegates Elect Directors; Denver Is '53 Host; Board, House Pledge Defense Support

JACOB J. DEMUTH, general superintendent and member of the executive committee, Sligo, Inc., St. Louis, Mo., is the man who will guide the Society during the next 12-month period of world emergency. Mr. Demuth was elected president of the American Society of Tool Engineers at the annual meeting of the board of directors in New York, March 13. The board meeting preceded a heavily attended three-day national convention at Hotel New Yorker.

In industry as in ASTE Mr. Demuth has come to the top by hard work, strong convictions and unflagging enthusiasms.

A St. Louis native, he began his industrial career at 15 as an apprentice machinist. By supplementing work experience with evening courses in engineering subjects, he had risen to superintendent of Midwest Manufacturing Co. by World War I.

During the second global conflict he was assistant to Stuart Symington, then president of Emerson Electric Co. and now head of the National Security Resources Board. In this capacity, Mr. Demuth developed from scratch the production techniques for the Sperry aircraft gun turret, then built a national organization for processing these turrets in quantity.

With other firms as for Emerson, he has been successful as trouble shooter, organizer and special assignment man.

He had held all the offices at his home chapter in St. Louis before being appointed vice-chairman and then chairman of the National Constitution and By-Laws Committee. Since 1948 he has been third, second, and first vice-president of the Society and a member of the board of directors.

A registered professional engineer, the new president is affiliated with the St. Louis, Missouri, and National societies of professional engineers, as well as with the St. Louis Engineers Club and the local chapter of ASM. He is also a member of the Army Ordnance Association.

Succeeding Mr. Demuth as first vice-president is Leslie B. Bellamy, district manager of Sterling Grinding Wheel Co., Detroit.

Roger F. Waindle, general manager, Industrial Products Div., Elgin National Watch Co., Elgin, Ill., has been stepped up from third to second vice-president.

Thomas J. Donovan, Jr., owner of Donovan Co., Philadelphia, Pa., and a

four-time national director, moves into the third vice-presidency.

National secretary is William A. Thomas, superintendent of tool engineering at Ford Motor Co. of Canada, Ltd., Windsor, Ont. Mr. Thomas was assistant secretary-treasurer last year.

To fill the post vacated by Mr. Thomas, Harry B. Osborn, Jr., technical director of Tocco Div., Ohio Crankshaft Co., Cleveland, Ohio, was elected.

The new treasurer is Howard C. McMillen, general superintendent of Seeger Refrigerator Co., Evansville, Ind.

Harry E. Conrad continues as executive secretary at the Detroit headquarters of the Society.

Four New Directors

The house of delegates, composed of chapter representatives, elected the 1951-52 board. H. E. Collins, chief production engineer, Hughes Tool Co., Houston, Texas; W. B. McClellan, Gairing Tool Co. engineer, Detroit; George A. Goodwin, chief process engineer, Master Electric Co., Dayton, Ohio, and Mr. Osborn were voted in as new directors. The first three named are retiring as second vice-president, secretary, and treasurer, respectively.

Incumbents returned to office are: Mr. Demuth, Mr. Bellamy, Mr. Donovan, Joseph P. Crosby, vice-president, The Lapointe Machine Tool Co., Hudson, Mass.; Edward W. Ernst, superintendent, Punching Tool and Die Div., General Electric Co., Schenectady, N. Y., and Ben J. Hazewinkel, district representative, L. S. Starrett Co., Denver, Colo.

The retiring president and board chairman, Herbert L. Tigges, executive vice-president of Baker Bros., Inc., Toledo, Ohio, serves as director through the annual meeting at Chicago next March.

Mr. Tigges swore in the officers at the annual dinner, March 16. The new directors take office at the board's fall meeting.

Appoints Committee Chairmen

Following his installation President Demuth appointed as national committee chairman: Andrew B. Clark, technical consultant, Haynes-Stellite Div., Union Carbide and Carbon Corp., Cleveland, Ohio, membership; Raymond C. Peterson, manager, Peterson Engineering Co., Toledo, Ohio, standards; Gardner Young, tool supervisor, Westinghouse Electric Corp., Pittsburgh, Pa., program.

William F. Jarvis, treasurer, Charles L. Jarvis Co., Middletown, Conn., finance; E. W. Ernst, book; Dick R. Linch of Southern California Pipe & Steel Co., Los Angeles, Calif., constitution and by-laws; Willis G. Ehrhardt, managing partner, Ehrhardt Tool & Machine Co., St. Louis, Mo., public relations; William F. Sherman, manager, engineering and technical department, Automobile Mfrs. Association, Detroit, editorial.

Jay N. Edmondson, professor, Production Div., Industrial Engineering, Ohio State University, Columbus, Ohio, education; Ralph I. Robbins, chief project engineer, Anderson-Nichols & Co., Boston, Mass., professional engineering.

Albert M. Sargent, president and general manager, Pioneer Engineering & Manufacturing Co., Detroit, research, and William H. Smila, master mechanic, Plymouth Div., Chrysler Corp., Detroit, judicial-honor awards.

For their 1953 annual meeting, tool engineers will journey to Denver. An invitation from the Colorado chapter was accepted by the board.

To select a site for the 1954 annual meeting and exposition, Mr. Tigges appointed a show committee composed of J. J. Demuth, G. A. Goodwin, and Fred J. Schmitt, director of sales, D. A. Stuart Oil Co., Chicago, Ill.

Resolution Goes to Defense Heads

Both board and house of delegates adopted a resolution pledging all-out support of the membership in prosecuting military and civilian production needs. Copies of the resolution will go to the directors of defense mobilization for the United States and Canada and to all chapters of the Society. It reads:

Whereas: The people of the United States of America and of Canada and of other nations believe in the dignity of man as an individual and in the principles of true democracy, and

Whereas: These principles and the future well-being of these peoples are threatened today both militarily and economically, and

Whereas: The peoples of these nations have determined through their governments to defend those principles, and

Whereas: The carrying out of this determination requires that 100 percent of available production know-how and tool engineering ingenuity be devoted to the twin tasks of meeting the requirements for both defense and essential civilian needs, and

Whereas: The application in industry of this know-how and ingenuity devolves mainly on the shoulders of the tool engineer, therefore

Be It Resolved: That the American Society of Tool Engineers, representing 18,000 tool engineers in 88 chapters in the United States of America and in Canada, through its delegates and directors at their 19th annual meeting unanimously pledges the all-out support of its membership to the carrying out of these twin tasks.

Other official business and convention news will be reported in the next issue of ASTE News.

Barker Directs Canadian Machine Tool Procurement

Toronto, Ont.—Edgar L. Barker, president of Modern Tool Works, Toronto, has been appointed director of the machine tool division of the Canadian defense effort. Mr. Barker's appointment was announced by C. D. Howe, trade and commerce minister, who is expected to head a new department of defense production.

Born in Yorkshire, England, Mr. Barker was educated in mechanical engineering and served his apprenticeship in that country. He was connected with firms in San Francisco, Calif., and Chicago, Ill., and with Canadian National Railways before becoming a partner in founding the Modern Tool Works in 1932.

The second chairman of the Toronto ASTE chapter, Mr. Barker has addressed Canadian chapters and the Society's national meeting at Montreal. He is a past president of the Canadian Machine Tool Builders Association.

In his new post he will have some association with Herbert L. Tigges, immediate past president of ASTE, and machine tool consultant to NPA.

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Jackson Tool Engineers Chartered as Chapter 87

Jackson, Mich.—ASTE extended its services into another industrial area when 65 tool engineers were chartered February 27 as Jackson Chapter No. 87. Approximately 70 members and visitors attended the charter dinner at the Cascades Park Clubhouse.

Glenndon G. Hilge, retiring chairman of the Waterloo Area chapter at Ann Arbor, welcomed the group, along with John S. Jeffery of Saginaw Valley chapter, Flint.

The membership elected a Nominating Committee composed of C. D. Burbank, Frank E. Gokay, William J. Levy, Howard D. Corwin, and Raymond E. Tetens.

Elects Gokay Chairman

From a slate of candidates subsequently submitted by this committee, the following officers have been chosen: Chairman, Frank E. Gokay, tool engineer, Teer, Wickwire & Co.; first vice-chairman, Edwin G. Small, vice-president, Dawlen Corp.; second vice-chairman, Robert O. Hoyt, design engineer, The Knickerbocker Co.; secretary, Robert J. Pioch, tool engineer, Aeroquip Corp., and treasurer, Robert M. German, vice-president, Fox Engineering Co.

L. B. Bellamy of Detroit, first vice-president and national director, presented the charter to Mr. Gokay, organizer of the Jackson ASTE group.

Acting as program chairman, Mr. Small introduced John T. Vaughan, works manager of the Tocco Div., Ohio Crankshaft Co., Cleveland, Ohio. Mr. Vaughan discussed "Induction Heating," using slide illustrations.

Other speakers were W. B. McClellan of Detroit, retiring national secretary and national director-elect; Harry E. Conrad, executive secretary of the Society; Charles M. Smillie, national membership committeeman and immediate past chairman of Detroit chapter, and William T. Ackerman, also of Detroit.

Guests from the Detroit headquarters office included Frank W. Wilson, book editor, and John S. Eacock, assistant to the executive secretary.

Charter members include: Phillip R. Billeter, Beyer Machine Co.; Nelson G. Brooks and Ira D. Orvis, Teere Wickwire & Co.; Ben W. Burton, Robert K. Kolster, Richard P. Manning, Arlo C. Snow, Walter J. Uchwal, Willard R. Cowan and Dwight W. Leavy, Aeroquip Corp.; Courtland L. Hill, Hill-Kennedy Tool & Mfg. Co.

William H. Ketts, W. H. K. Machine Co.; William J. Levy and Charles R. St. John, Industrial Steel Treating Co.; Vaughn W. Penive and Philip L. Reynolds, Hy Air Products Co.; Charles B. Rendall, Rendall Tool and Gauge Co.; Melvin A. Schalhamer and Julien J. Van Maele, Allied Engineering Co.

L. B. Bellamy, first vice-president of ASTE, presents Jackson chapter's charter to Frank E. Gokay, chairman of the new group.

Raymond C. Schrader, Schrader Machine & Tool Co.; Raymond E. Tetens, Robert M. Townley and Robert G. Wickham, Hayes Industries, Inc.; James E. Thomson, Western Stamping Co.; Bert O. Warren and Walter Wasilew, Dawlen Corp.; James N. Wiltsie and Irvin J. Ziegler, G & Z Automatic Products Co.

Carl E. Wolcott, Diecast Corp.; Howard D. Corwin, Stephen V. Eisele, Roscoe J. Pratt, Robert H. Smith and Samuel Worthington, Fox Engineering Co.; Ray E. Calbert, Ray Calbert Mfg. Corp.; Joseph R. Elder, John F. Gillett, and Daryle G. Hatt, Tomkins Johnson Co.; Francis L. Hyde and Norman B. McKay, Wilcox Gay Corp.

Richard H. Merchant, Norton Co.; Raymond A. Potts, Central Machine Co.; Merrill H. Schaeffer, Yard Mfg., Inc.; Walter E. Spieth, William V. Pemberton, Theodore Vickers and John H. Calhoun, Clark Equipment Co.; Edward P. Stringham, Commonwealth Association; C. D. Burbank, Mechanics Engineering Co.; Benjamin C. Evans, Jr., Muskegon Motor Specialties Co. and Fred Hehl, Hancock Mfg. Co.

Kenneth J. Horton, Carl C. Kressbach Co.; Max C. Huling, Alvin L. Holton and Donald J. Ross, Design Service; B. D. Jacokes, Walker Mfg. Co.; J. Stanley Jeffery, Consumers Power Co.; Richard O. Lane, Macklin Co.; Emmanuel G. Miller, Miller Machine & Tool Co.; John E. Atkinson, Allied Products Corp.

Special Service Award Is Chapter Work Incentive

The member who accepts chapter assignments willingly and repeatedly and turns in an outstanding performance is now recognized. He is the recipient of the first annual chairman's award pin, presented by the outgoing chief executive of each chapter.

Sponsored by the National Membership Committee, under H. B. Osborn, Jr., retiring chairman, the award pin is similar to the regular senior membership emblem. The ASTE letters are superimposed in white enamel on a gold sunburst against a blue background. A red enamel bar, inscribed "Service," is attached to the lower point of the pin.

Purpose of the token of appreciation is to foster a higher degree of cooperation within chapters by citing especially meritorious service.

Fort Wayne Inducts New Officers —Left: In chairman's absence, Paul Berlien, first vice-chairman of Fort Wayne chapter, presents service award pin to Minard Rose, professor of mechanical engineering at Tri-State College. Right: Newly installed officers are, from left: Oscar McDowell, first vice-chairman; Donald Welbaum, secretary; Everett Keese, second vice-chairman; George Hahn, treasurer, and Ralph Didier, chairman.

Left: J. J. Demuth, Society president, swears in his home chapter officers at St. Louis. From left: John Ford, treasurer; W. G. von Weise, secretary; William Bachman, second vice-chairman; E. P. Huchzermeier, first vice-chairman; L. W. Greenblatt, chairman, and Mr. Demuth. Right: Detroit chapter executives take their oaths from L. B. Bellamy, first vice-president. From left: Charles W. Ward, secretary; John W. Wagus, treasurer; William F. Sherman, second vice-chairman; Andrew M. Grant, first vice-chairman; John D. Anderson, chairman, and Mr. Bellamy.

New Chapter Officers Assume Duties at March Installations

St. Louis, Mo.—Approximately 360 members and guests of St. Louis chapter witnessed the inauguration of officers at the annual executives night, March 1, at DeSoto Hotel.

In the absence of H. L. Tigges, retiring president, J. J. Demuth, his successor, installed: L. W. Greenblatt, chairman; E. P. Huchzermeier, first vice-chairman; William Bachman, second vice-chairman; William von Weise, secretary; John Ford, treasurer; Emil Stempfle, delegate, and Mr. Greenblatt as alternate.

Schafermeyer Receives Award

The first chairman's award pin was presented to Eric Schafermeyer for his outstanding service on the Picnic Committee for the past four years.

Principal speaker was George A. Bowie of the public relations department of Firestone Tire & Rubber Co., Akron, Ohio. Mr. Bowie's subject, "How Do I Look," concerned current affairs. He pointed out that our nation was built to greatness by "individuals," not by average men. We can't live in a democracy as free men and be a small part of an average people, he stressed.

In response Chairman Greenblatt commented that "tool engineers are 'individuals' versed in methods of expediting production."

INDIANAPOLIS, IND.—F. W. Hilkenbach assumed the chairmanship of Indianapolis chapter at an installation ceremony held March 1 at the Athenaeum.

Other officers inducted with Mr. Hilkenbach are: Denis White, first vice-chairman; George Duncan, second vice-chairman; Joe Penn, secretary; J. P. Enright, treasurer; R. F. Krause, delegate, and H. W. Kurfman, alternate.

Following the installation Albert J. Collet was awarded the chairman's service pin.

Joseph Koske of Eutectic Welding Alloys Corp., New York, spoke to the tool engineers concerning possibilities of worthwhile savings through new low temperature welding procedures developed by his company.

Prior to the meeting dinner was served to 71 members and guests. Other members joined the group for the technical session.

DETROIT, MICH.—Ladies night was observed at a meeting of Detroit chapter, held March 8 at the Engineering Society of Detroit.

Following dinner the elected officers were sworn in by L. B. Bellamy, recently elected vice-president of the Society. The officers are: John D. Anderson, chairman; Andrew M. Grant, first vice-chairman; William F. Sherman, second vice-chairman; Charles W. Ward, secretary, and John W. Wagus, treasurer.

Representing the 1950-51 officers and committee chairmen, Mr. Anderson presented Charles M. Smillie, retiring chairman, with a desk pen and pencil set.

The remainder of the evening was spent dancing to the music of Eddy Shick's band.

POUGHKEEPSIE, N. Y.—Induction Hardening was the technical subject at the March 13 meeting of Mid-Hudson chapter, with Dr. Harry B. Osborn, technical director, Tocco Div., The Ohio Crankshaft Co., Cleveland, Ohio, as speaker.

Osborn Is Installing Officer

In his capacity as national membership chairman, Dr. Osborn administered the oath of office to: William W. Schug, chairman; Joseph A. Crane, first vice-chairman; Charles W. Brownell, second vice-chairman; Henry J. Tesmer, secretary, and Harry N. Carlson, treasurer.

Chairman Schug announced the following committee appointments for the year: Frank Plotnik, membership; Joseph Nelson, program; C. Henry Beiderbecke, publicity and editorial; Ray Lansing, dinner and entertainment; Walter A. Stadtler, standards; Noel de Cordova, finance; Jack Petz, education; Joseph Petz, historian, and Harold De Pew, constitution and by-laws.

Immediately following dinner Wilber R. R. Winans, secretary of the Poughkeepsie Chamber of Commerce, gave a coffee talk entitled "March 15."

Ellis W. Thorp, retiring chairman, presided.

MONTREAL, QUE.—On March 8 Paul Cloutier was installed as chairman of Montreal chapter by G. A. Rogers, national program chairman. Other officers sworn in by Mr. Rogers are: C. J. McDowell, first vice-chairman; C. J. Gareau, second vice-chairman; T. C. Hill, third vice-chairman; Jean M. Masse, secretary, and T. J. Tracey, treasurer.

Samuel Pedvis, retiring chairman, thanked his officers and committeemen for their work during the year and presented J. R. Houghton with the ASTE service pin for his outstanding work as education chairman.

Welding Corrosion Eliminated

Fred Schneider, the technical speaker, discussed Aircomatic Welding. Until a few years ago, Mr. Schneider pointed out, the only means of welding magnesium was by the oxyacetylene process. Any flux remaining in or around the weld caused severe corrosion. The inert-gas-shielded tungsten arc welding process, introduced in 1942, has overcome this problem, according to Mr. Schneider. It is used not only for welding magnesium, but also on aluminum, stainless steel, the nickel alloys, copper and other metals.

Stolan Audet thanked the speaker for his lecture.

KANSAS CITY, MO.—New officers at Kansas City chapter were ushered in during the annual inaugural ball, March 7, at the American Legion Hall. The function was attended by 229 members and guests.

Following dinner A. J. Mirick, a former chairman, installed incoming officers: Ivan Nelson, chairman; Jack

Needham, first vice-chairman; Earl Hudson, second vice-chairman; John Hoover, secretary, and Merlin Grundy, treasurer.

W. H. Lebo, retiring chairman, presented the chairman's award pin to A. N. Brunson for his outstanding service to the chapter since its founding.

Some 100 door prizes were distributed during intermission, and the evening continued with dancing.

WASHINGTON, D. C.—Exhibiting an extraordinary display of chrome plated items, B. A. Taylor, vice-president of the Chrome-Electro Forming Co., Detroit, addressed Potomac chapter's March dinner meeting, on "Hard Chrome Plating to Size."

Mr. Taylor discussed this subject at the Society's 19th annual meeting in Philadelphia. His paper appeared in the April 1950 issue of *The Tool Engineer*.

Navy Sends Representatives

The Washington audience included representatives of naval establishments from Pearl Harbor to New England and Navy men from the Bureau of Ships.

After the lecture an informative color film, "Light Metal Press Forgings," was shown.

Installation of the following officers preceded the lecture: B. E. Thomasson, chairman; W. E. Jones, first vice-chairman; H. T. Richardson, second vice-chairman; E. S. Parsons, secretary, and E. M. Seifert, treasurer.

Chairman Thomasson spoke briefly on his aims and ambitions for the chapter in the coming year and named chairmen of various committees.

PITTSBURGH, PA.—W. J. Bickmore was installed as chairman of Pittsburgh chapter at the March 2 meeting. Others taking the oath of office from G. C. Wood, retiring chairman, were: H. L. Harper, first vice-chairman; L. J. Brozek, second vice-chairman; Fred Hennig, secretary, and Elwood Weissert, treasurer.

Service Pin Goes to Lloyd

The newly created chairman's award was presented to J. M. Lloyd, program chairman.

More than 100 members and guests enjoyed a buffet luncheon and an evening of Monte Carlo, played with stage money.

NEW HAVEN, CONN.—March meeting of New Haven chapter was highlighted by an inauguration dinner attended by approximately 60 members and guests.

Gerard P. Schoeller, a past chairman, installed as incoming officers: David J. Mathewson, chairman; John H. Alton, first vice-chairman; Emanuel Lull, second vice-chairman; John Brozek, secretary, and John S. Diefenbach, treasurer.

M. J. Radecki, outgoing chairman, read a report of his year in office and presented a service award to Mr. Schoeller for his untiring efforts on behalf of the Society.

Technical Chairman John Diefenbach introduced the speaker, Rene Paul Magnenat, vice-president in charge of engineering of the Waterbury Companies, Waterbury, Conn.

Color slides and samples illustrated his subject, "Tooling for Molding of Plastics."

Before the meeting closed Chairman Mathewson presented his new working committees for the year.

ST. CHARLES, ILL.—At the March 6 meeting of Fox River Valley chapter, officers were installed as follows: George Bodi, chairman; George Parsons, first vice-chairman; Philip Shaner, second

These officer groups are among those installed at March chapter meetings. From top: E. W. Dickett (left) of Rockford, former national officer, inducted Fox River Valley executives. From his right are: Donald Zierk, treasurer; George Bodi, chairman; George Parsons, first vice-chairman; G. M. Waller, delegate; Charles Olson, secretary, and Philip Shaner, second vice-chairman. Harry Springer, former chairman of Potomac chapter, congratulates B. E. Thomasson, new chairman, after swearing in '51-52 officers. From left: E. M. Seifert, treasurer; H. T. Richardson, second vice-chairman; Mr. Springer, W. E. Jones, first vice-chairman; Mr. Thomasson, and Eugene Parsons, secretary. Gerard Schoeller (right), a past chairman, reads oath of office to men elected to direct New Haven chapter. From left, they are: John Diefenbach, treasurer; J. S. Brozek, secretary; John Alton, first vice-chairman, and David Mathewson, chairman. At Pittsburgh G. C. Wood (left), retiring chairman, inducts W. J. Bickmore, chairman; H. L. Harper, first vice-chairman; L. J. Brozek, second vice-chairman; Fred Hennig, secretary, and Elwood Weissert, treasurer.

vice-chairman; C. A. Olson, secretary, and Donald Zierk, treasurer.

The social program consisted of a stag with motion pictures, door prizes, and other entertainment.

WORCESTER, MASS.—Highlights of the recent Industrial Mobilization Seminar held at the University of Massachusetts constituted the March technical session of Worcester chapter. The dinner meeting was held at the Uxbridge Inn, Uxbridge. A scheduled visit to the Bachman-Uxbridge Worsted Corp. was cancelled due to union picketing of this plant.

Roger Johnson, economist of the Associated Industries of Massachusetts, reviewed production policies, area manpower controls, wage and price stabilization, and problems of peak production for military needs as presented at the seminar.

Bypassed in Prime Contracting

Mr. Johnson also touched on the lack of prime military contracts in the New England area and the ability of this section to handle such contracts. Percentage figures quoted by the speaker did not take into consideration that much of New England industry is at work furnishing machinery and other equipment to prime contractors. A brief question period followed this session.

Prior to the technical program V. H. Ericson, national director, installed the following newly elected officers: Ralph A. Baker, chairman; E. Roland Ljungquist, first vice-chairman; Bernard D. Szarek, second vice-chairman; John E. Rotchford, secretary; John N. Englested, treasurer; Carroll L. Morse, delegate, and Thomas C. Bradford, alternate.

Mr. Morse, the outgoing chairman, and Mr. Baker, his successor, both presided during the meeting.

PEORIA, ILL.—E. E. Opel, electrical engineer for National Automatic Tool Co., Inc., Richmond, Ind., addressed the March 6 meeting of Peoria chapter. His topic, "Electrical Control of Machine Tools," was presented to 150 members attending a dinner meeting at the Jefferson Hotel.

Mr. Opel was introduced by Richard C. Kolb, technical chairman for the evening.

Gains 80 Members in Year

Robert Bayless, retiring chapter chairman, summarized the year's activity and expressed his gratitude to committees and membership for an increase of 80 new members during his administration. Mr. Bayless presented the service award to E. F. Bain.

Harold Smith, a former chairman, installed the elected officers for the coming year. Activities planned for the new season were outlined by Duane H. Brighton, incoming chairman.

T. J. Donovan, Jr. (left), ASTE third vice-president, swears in Erie officers: Edwin Norgren, second vice-chairman; Leo Weiner, secretary; Harry Rudd, treasurer; Joseph Halmi, first vice-chairman, and Robert Wilson, chairman.

Wives of Boston members were present for chapter's installation ceremony. Officers, from left: Wilfred B. Wells, second vice-chairman; Prescott A. Smith, chairman; Harold L. Seekins, first vice-chairman; John Leach, secretary, and Karl G. Nowak, treasurer.

ERIE, PA.—A past president of ASTE was technical speaker at Erie chapter's March 6 meeting at Gannon College.

Shows Punching Procedure

Otto W. Winter, president of Winter Engineering Co., Buffalo, N.Y., explained "A New Concept in Punching." Aided with slides Mr. Winter pointed out the many causes of punch failure and ways of correcting them.

While commenting on the Society's progress, he stressed the importance of getting colleges to recognize tool engineering as a science.

T. J. Donovan, Jr., national director from Philadelphia, was the coffee speaker and installing officer. He administered the oath of office to: Robert Wilson, chairman; Joseph Halmi, first vice-chairman; Edward Norgren, second vice-chairman; Leo Weiner, secretary, and Harry Rudd, treasurer.

Mr. Donovan challenged the chapter to increase its membership 50 percent in the coming year.

Stanley Sadoski, outgoing chairman, awarded the chairman's service pin to Walter Cebelinski, public relations chairman, for accepting and executing assignments beyond the line of duty.

The audience of 50 members and guests included the following out-of-town visitors: Ray C. Neal, Neal & Co., and Frank Beauvea, Vanadium Alloys Steel Co., Buffalo, N.Y.; Leon Boulay, Talon, Inc., and E. A. Atkinson, Meadville, Pa., and G. C. Wood, immediate past chairman of Pittsburgh chapter.

FOND DU LAC, WIS.—Ninety members and guests from towns in the Fond du Lac chapter area met March 9 at the Town Grill, Oshkosh, to see the chapter's new officers installed and to hear a technical talk.

Schroeder Swears in Officers

A. F. Schroeder, a past chairman, conducted the installation of: Charles Billberg, chairman; Erwin Kaiser, first vice-chairman; Roger E. Kahlenberg, second vice-chairman; John O. Bahr, secretary, and Paul V. Rohling, treasurer.

The speaker of the evening, Robert Groman of Eutectic Welding Alloys Corp., described the latest procedures for salvaging die materials and high speed cutting tools with welding alloys.

Chairman Billberg addressed the group briefly before the meeting adjourned.

BINGHAMTON, N.Y.—Binghamton tool engineers entertained their ladies at an installation dinner, March 7, at Vestal Steak House.

Donald Ellis was sworn in as chairman, along with: William Leindecker, first vice-chairman; Howard Bertholf, second vice-chairman; Phillip Taylor, secretary, and David O. Williams, treasurer.

George Conine, retiring chairman, introduced Kenneth Van Cott, a former chairman of the American Gem Society, as guest speaker. His talk and exhibit of precious stones were of particular interest to the women guests.

Kenneth McDevitt, baritone, accompanied by Paul Loomis, pianist, entertained with songs and ballads.

Small Lot Duplicating Feasible

TORONTO, ONT.—It is economical to use a modern duplicating lathe for as few as four or five similar parts, Edgar Barker of Modern Tool Works, Toronto, told his fellow members at Toronto chapter's March 7 meeting. Mr. Barker spoke on "Duplicating Techniques."

More than 100 men heard his detailed description of how an hydraulic duplicator is applied to lathe, milling machine, planer or shaper; how sensitive is the control mechanism, and how simple the production of master forms. In most cases the first production specimen may be used as a master in a lathe.

holding dimensions to limits of plus or minus 0.001 in.

Slides showed dimensioned drawings giving low production times at extremely high speeds and moderate horsepowers. The talk was climaxed by color films made by Mr. Barker.

R. B. Douglas of Montreal, a former ASTE president, installed as 1951-52 officers: D. R. Cooper, chairman; Fred J. Lockhart, first vice-chairman; David R. Few, second vice-chairman; Clifford P. Farr, third vice-chairman; Kenneth R. Laidley, secretary; Bruce Fairgrieve, treasurer; John B. Burk, delegate, and Mr. Cooper as alternate.

ROCHESTER, N.Y.—Accuracy in the setting of cutting tools combined with correct procedures for precision boring have made it possible for industry to reduce machining costs by multiple operations and higher cutting speeds and feeds.

Glenn C. Moore of Heald Machine Co. emphasized this during a talk on precision boring at Rochester chapter's March 5 meeting. With slides Mr. Moore showed features of machines and setups involved and discussed precautions necessary to successfully produce some of the parts illustrated.

Horne Inducted as Chairman

Before the technical session William Gordon, a former chairman, read the oath of office to: James O. Horne, chairman; Charles L. DeMartin, first vice-chairman; Donald Kohler, second vice-chairman; Gerald Sick, third vice-chairman; Norman W. Fowler, secretary, and Robert T. Barnett, treasurer.

After briefly outlining plans for the coming year, Chairman Horne asked Mr. Kohler to introduce the speaker.

Emmett Moore, retiring chairman, presented the chairman's award pin to Larry C. Bates of the Program Committee, whose service to the chapter has required much personal time and effort.

Mr. Moore expressed his appreciation to the members and the executive committees who had served with him.

Bean Demonstrates Automatic Transmission

Rockford, Ill.—The new Ford automatic transmission was explained and demonstrated to Rockford members at their February meeting.

Nevin L. Bean, master mechanic from the Ford Motor Co.'s Cincinnati plant, displayed a complete transmission and disassembled parts during his discussion. A film, "From Ore to Motive Power," explained the construction of his company's engine.

Dinner preceded the meeting, followed by a coffee talk on the Rockford Symphony Orchestra by Harold Johnson of Barnes Drill Co.

To Award Gold Medal For Arc Welding Paper

Detroit, Mich.—A gold medal award for the best paper "relating to the advancement of the theory and practice of the arc welding process in the field of tool engineering" has been announced by W. H. Smila, ASTE honor awards chairman and master mechanic at Plymouth Div., Chrysler Corp.

Sponsored by the James F. Lincoln Arc Welding Foundation, the award is for an original contribution, not a development already known. It is open only to members of ASTE. Nominations must be submitted by November 15.

The medal and an engraved certificate will be presented to the winner at the Society's annual dinner in Chicago next March.

For information and rules governing the competition, use the coupon on Page 106.

Left: Emmett Moore, retiring chairman of Rochester chapter, presents award pin to Larry Bates. Below: W. R. Gordon, a former chairman, installs, from left: Norman Fowler, secretary; Robert Barnett, treasurer; Donald Kohler, vice-chairman, and James Horne, chairman.

Pacific Coast Chapters Sponsor Evening Courses

Portland, Ore.—Extension courses in Tool Engineering and Tool Design are being given at Oregon State College, under the auspices of the Portland ASTE chapter.

The classes opened March 1 and are being held weekly at the Oregon Journal Building for 10 weeks.

Subjects include: Jig and Fixture Design, Quality Control, Practical Shop Mathematics, Punches and Dies, Die Casting and Plastic Dies, Problems of Industrial Management, Economics of Tool Design, Welding Fixtures, Heat Treating, and Grinding.

While there are no academic entrance requirements, credits are available to college men taking the courses.

SAN FRANCISCO, CALIF.—In conjunction with the Oakland Board of Education, Golden Gate chapter is presenting a 14-week course in Fundamentals of Tool Engineering and Tool Design at the Laney Trade and Technical Institute in that city.

Since February 27 the class has been meeting Tuesday and Thursday evenings at the Laney school.

India Wants Hartford Course in Human Engineering

In its role of helping ASTE'ers interchange information, *The Tool Engineer* gets around to Hartford, Conn., and Bangalore, India.

Capitals of their respective states, the two cities are comparable in population. Although half a world apart, they are kin in engineering interests.

When H. C. Nagabhusbana of the East Indian manufacturing center picked up his October 1950 *Tool Engineer* after its long journey to him, he read about Hartford chapter's course in Human Engineering.

Mr. Nagabhusbana, senior tool inspector at Hindustan Aircraft, Ltd., wanted to promote a similar activity among his associates and fellow engineers. So he sat down and wrote to Hartford for more information. He is getting it from James Neville. Author and director of the course, Mr. Neville has had experience in directing a nationally known public speaking program.

In India or the U.S. good leadership is in critically short supply. By broadcasting its activities, ASTE is contributing its bit of constructive thinking in this sphere.

Home Talent Presents Triple-Header Program

Galt, Ont.—Member talent provided the program for a recent meeting of Grand River Valley chapter at Golden Lions Hall, Kitchener.

Harry Sehl, acting chairman in the absence of Harry Whitehall, introduced the first speaker, Charles Spicer, foreman of Leland Electric Co., Guelph. Mr. Spicer talked on "Tooling Methods in Production of Fractional H.P. Electric Motors." He outlined phases of precision production tooling and processing for the multitude of parts required in motor manufacture.

Cooperation Vital to Production

Presented by Percy Barber, Mr. Sehl, manager and owner of Sehl Engineering, Kitchener, discussed "Successful Production Through Labor-Management-Supplier Cooperation." Financiers, suppliers, management and labor must all work together in setting up a manufacturing business, Mr. Sehl pointed out. Labor-management cooperation, he emphasized, is the first step to successful production.

The final speaker was Joseph Strite, engineer of Whitehall Industries, Hespeler. His subject, "Some Grinding Hints," concerned all phases of cylindrical and surface grinding from the sequence of operation to detailed precautions on processing for final precision results. The audience gained useful hints for everyday grinding. Frank Lewis introduced Mr. Strite.

A Nominating Committee was appointed to propose a new slate of officers. Following adjournment a buffet luncheon was served.

Prior to the technical program a film, "Battle of Britain," was shown.

Rochester, Mid-Hudson Entertain Their Ladies

Rochester, N.Y.—Rochester members dined and danced their ladies at the Brooklea Country Club, February 24. Each woman guest received a gardenia corsage and a lapel pin favor.

Throughout the dinner strolling musicians entertained the party. The remainder of the evening was spent dancing to Frank Skultoty's orchestra and visiting in little groups.

Emmett Moore, chairman, and James Horne, first vice-chairman, commended the Entertainment Committee on their arrangements for the affair. The committee consisted of Gerald Seek, Ernest Schramm and Arthur Lang.

POUGHKEEPSIE, N. Y.—Poughkeepsie Tennis Club was the scene of Mid-Hudson chapter's annual ladies night, held February 17.

Dancing to the music of Van Henery's orchestra was enjoyed by 190 members and their women guests. Each lady was presented with a surprise gift. Door prizes also were awarded. During the latter part of the evening a buffet supper was served.

Phalen Heads Up Committee

On the committee in charge of the affair were: Edward Phalen, chairman; Joseph Crane, Walter Stadtler, Fred Henning, Albert Payne, Joseph Spahn, Hunt Otis, Frank Plotnik, Harry Finger, Joseph Nelson, Harry Sanctuary, C. H. Beiderbecke, Samuel Enright and the executive committee: Ellis W. Thorp, Ornendo Freer, Kenneth L. Snover, Morris O'Hehir, William W. Schug, Frank Kopf, Noel de Cordova, Floyd Tilton, Harry N. Carlson and Joseph L. Petz.

New Grinding Method Lengthens Punch Life

Utica, N. Y.—Mohawk Valley chapter presented "A New Concept in Punching" at a recent technical meeting in the Moose Home, attended by approximately 40 members.

Fred Barker, chairman, presided and introduced Otto Winter of Winter Engineering Co., Buffalo, a former ASTE president. Mr. Winter discussed special research work on a new method of grinding punches for longer life. The talk was accompanied by pictures showing punches being ground lengthwise while rotating.

Robert Coleman of the Tool and Machinery Sales, Buffalo, followed Mr. Winter with a description of newly developed, electronically controlled safety devices for punch presses. These devices effectively prevent operators from being injured. As hands approach dangerously close to the moving punch, the action is automatically stopped.

Each speaker answered questions at the close of his lecture.

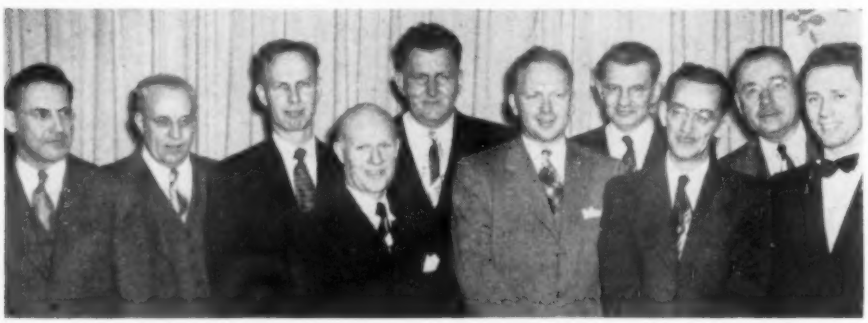
A Nominating Committee was elected during the meeting.

Visit Refrigerator Plant

Minneapolis, Minn.—Some 180 members and friends of Twin City chapter were recent guests of Seeger Refrigerator Co., St. Paul.

Parts of the plant were kept running especially so that the evening visitors could see actual operations in the manufacture of refrigerators and deep freezers.

Company guides answered questions along the tour route.



Left: On committee responsible for successful ladies night party at Mid-Hudson chapter were, from left: Joseph L. Petz, William W. Schug, Edward M. Phalen and Joseph A. Crane, co-chairmen; Frederick Hennig, Walter A. Stadtler, Floyd B. Tilton, Sr., Joseph J. Spahn, Ellis W. Thorp, and Albert H. Payne, Jr. Below, left: Twin City members inspect unit room of Seeger Refrigerator Co. during a recent tour of this plant. Right: Rochester tool engineers and their ladies enjoy an evening of dancing at the Brooklea Country Club.

Scholarships Announced To Engineering Schools

Detroit, Mich.—Availability of five national scholarships to be awarded by the Society has been announced to deans of engineering of 126 educational institutions accredited by the Engineers Council for Professional Development. The announcement was issued by Jay N. Edmondson, national education chairman of ASTE and professor in the industrial engineering department of Ohio State University, Columbus, Ohio.

According to the conditions named, the first grants are to be made this fall to fourth and fifth year students electing tool engineering curricula and interested in entering this field as a profession. Four of the scholarships will be awarded in the U.S. and one in Canada.

Payment will be at the rate of $100 per quarter to a possible total of $300, or $150 per semester.

Selection of the recipients will be based on information contained in the application, plus the recommendation of a screening committee "which may consist of faculty members and delegated members of the local chapter education committee." The final decision rests with the National Education Committee. Applications must be submitted to the committee for consideration by June 15.

Tool Engineers Handbook Is Reprinted Abroad

Despite blocked currencies tool engineers in England and on the Continent have bought thousands of copies of the "Tool Engineers Handbook." Foreign sales have passed 4000, including copies shipped to the Orient.

Anticipating continued heavy demand, the publishers have reprinted the Handbook abroad. Overseas engineers may now purchase it for the equivalent of the $15 list price in the U.S., a saving of nearly $5 in hard currency.

Price of the book is £5 7/6 (or equivalent) from European bookstores or from McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, London WC 2, England.

Since its initial printing less than two years ago, the Society's first tool engineering manual has sold nearly 25,000 copies.

Joins Plymouth Firm

Detroit, Mich.—Walter Panse has announced his connection with Plymouth Gage & Tool Co., Plymouth, Mich., as partner and manager. He was formerly owner and president of Reich Machinery Rebuilding Co., Dayton, Ohio.

Mr. Panse has transferred his ASTE membership from Dayton to Detroit.

Toledo chapter officers pause around display table during tour of Spicer Mfg. Div. of Dana Corp. From left: Dale Burke, second vice-chairman; August Ehrhardt, a past chairman, and chief production engineer of Dana Corp.; Elmer Faber, secretary; Philip Lindhuber, chief tool designer of Spicer; Raymond Peterson, chairman; Joseph Kertz, membership chairman, and Richard Sullivan, program chairman.

Newton, Gilbert Advanced

Athol, Mass.—Two ASTE'ers have been named in promotions recently announced by W. J. Greene, vice-president and director of sales for The L. S. Starrett Co.

Carl O. Newton, previously manager of the New York branch has been appointed eastern sales manager. Donald E. Gilbert, formerly in charge of the

D. E. Gilbert

C. O. Newton

Western New England territory, will also assume the management of the New York branch.

Mr. Newton is affiliated with Worcester chapter and Mr. Gilbert with Northern New Jersey chapter of ASTE.

Danly Appoints Morgan

Fond du Lac, Wis.—Everett K. Morgan of Fond du Lac chapter has been named general sales manager for the mechanical press line of Danly Machine Specialties, Inc., Chicago, Ill., R. C. Berggren, advertising manager, has announced.

Since 1937 Mr. Morgan has been associated with Giddings & Lewis Machine Tool Co. of Fond du Lac as vice-president and manager of engineering.

Spicer Holds Open House For 500 in Toledo Tour

Toledo, Ohio—Spicer Manufacturing Div. of Dana Corp. was host to more than 500 Toledo members and their wives for a plant tour February 22. It was the largest attendance ever recorded in the chapter's history.

Operations observed in the plant included milling, broaching and grinding. Special fixture setups for drilling, reaming and tapping were explained by guides.

The careful arrangements made by company personnel under the guidance of R. G. Milne, personnel manager, in cooperation with Philip Lindhuber, chief tool designer, resulted in a smoothly conducted tour. Precautions for the comfort of the visitors included safety goggles for inspection of the forge shop.

At the conclusion of the tour refreshments were served in the office staff's cafeteria.

Caterpillar Advances Three Peoria ASTE'ers

Peoria, Ill.—Three members of the Peoria ASTE chapter were promoted in recent appointments at Caterpillar Tractor Co.

Robert E. Gilmore, formerly scheduling manager, has been named assistant manager of the engine plant. To fill the vacancy created, Don Hartter was advanced from superintendent of tool cribs. Mathew C. Aljanich, a tool engineer, succeeds Mr. Hartter in the latter capacity.

Philadelphia officers are inducted by Thomas J. Donovan, Jr., third vice-president of the Society and a local member, on the chapter's 13th anniversary. From left: Emil Kitzman, alternate; Frank DeFrates, treasurer; Howard Gross, secretary and delegate; Campbell Pittsinger, second vice-chairman; Albert Luecke, first vice-chairman; Willard Griffith, chairman, and Mr. Donovan.

Members Vote for 1951-52 Officers in Chapter Elections

Philadelphia, Pa.—When Philadelphia chapter observed its 13th anniversary, February 15, at the Engineers Club, it paid homage to past chairmen, elected and installed new officers, singled out a member for recognition of meritorious service, and listened to a technical lecture.

Charter Chairman Cuts Cake

Conrad O. Hersam, first chairman of the group, briefly reviewed the chapter's early struggles and congratulated the membership on its present success. Mr. Hersam cut a birthday cake for a table of past chairmen, including: John Strecker, Foster Crayton, Emil Kitzman, Charles Crook, Thomas Donovan, Jr., Howard Gross and Samuel Boyer.

Several other former chapter heads were absent through illness.

Chairman R. S. Paulsen conferred the chairman's award pin on Charles K. Lennig, Jr. As chairman of the Registration and Reception Committee for the past four years, Mr. Lennig has handled details of banquets and receptions, and ticket sales. During the annual meeting at Philadelphia last year, he was banquet chairman. He is also secretary of the chapter Scholarship Committee.

Griffith Is '51 Chairman

Officers for the coming season, elected during the meeting, were sworn in by T. J. Donovan, Jr., national director. They are: William Griffith, chairman; Albert Luecke, first vice-chairman; Campbell Pittsinger, second vice-chairman; Howard Gross, secretary; Frank DeFrates, treasurer; Howard Gross, delegate, and Emil Kitzman, alternate.

Before the voting Fred Holden, nominating chairman, reported on the qualifications of each candidate. The members learned with regret that Kenneth Riddle had resigned as first vice-chairman since business duties prevented his continuing in office and accepting the chairmanship.

R. S. Paulsen, outgoing chairman, was presented with a leather-bound copy of the "Tool Engineers Handbook," a past chairman pin and a gift certificate in appreciation of his services.

Samuel Boyer, Vincent Powers and Edward Hollingsworth were appointed to the Auditing Committee.

Jet Tooling Must Be Flexible

The guest speaker, Richard A. Powley, senior production engineer for I-T-E Circuit Breaker Co., Philadelphia, discussed tooling for jet engine combustion systems. Low cost setup and maximum flexibility, he said, have been the chief concern in selecting tooling for sheet metal parts and assemblies. Relatively low production and frequent engineering revisions prohibit conventional high production press tooling. The speaker showed slides illustrating Kirksite tooling and explained advantages of this material.

During dinner Arthur Dillahay and his Arizona players entertained an audience of 142 members with western songs.

ROCHESTER, N. Y.—A tour through Yawman Metal Products Co. highlighted the February 12 meeting of Rochester chapter.

Victor G. Yawman, president, welcomed the visitors and conducted them through his plant, explaining problems encountered in the company's operations.

Modern Methods Impress Engineers

The entire group was impressed with the layout of machines utilizing mechanical handling between operations, air guards for worker safety, dial feeds and transfer equipment.

A buffet luncheon was served at the conclusion of the tour.

In a business meeting preceding the plant inspection, new officers were elected, and reports were given by William Auer, membership chairman;

Safety precautions at Yawman Metal Products Co. impress Rochester members on tour through plant, as they observe air guard in position prior to trip of press.

Gerald [illegible]ick, entertainment chairman; James O. Horne, first vice-chairman, and Milton Roessel of the National Editorial Committee.

NEW HAVEN, CONN.—February dinner meeting of New Haven chapter was held at the Hotel Garde on the 8th and attended by 60 members and guests.

Technical Chairman Frank Gilbert introduced William B. Retz, chief engineer of the New Britain-Gridley Co., as the speaker of the evening. Mr. Retz talked on "Automatic Screw and Chucking Machines" and showed color films.

A slate of officers, presented by the Nominating Committee, was voted in during the meeting.

WILLIAMSPORT, PA.—N. M. Perris of Stevenson, Jordan & Harrison, New York consulting engineers, was the technical speaker at the February 12 dinner meeting of Williamsport chapter, held at the Anglers Club.

Production Begins With T. E.

A good product at reasonable cost must start with the tool engineer, Mr. Perris stated, in opening his lecture on Methods Engineering. After pointing out the savings possible in assembly lines, the speaker analyzed detail parts for further cost reductions.

H. K. Keever, a process engineer with the same firm, volunteered to answer questions at the close of Mr. Perris' talk.

Richard Huskin, vice-chairman, introduced the speaker.

How tobacco is grown, cured, and mechanically processed into cigars was revealed in a film shown by William Paul, a chapter member.

New officers elected during the meeting are: Richard Huskin, chairman; Morris Smith, first vice-chairman; William McCoy, second vice-chairman; Joseph Gehret, secretary, and Roy Reiter, treasurer.

William Belknap, retiring chairman, was the presiding officer.

HAMILTON, ONT.—In keeping with custom for the past few years, speaking assignments for Hamilton chapter's election night meeting were handled by chapter members.

Jet Parts Are Crush Ground

Max Samuely, senior tool designer, Canadian Westinghouse Co., Ltd., explained fundamentals and fine points of crush dressing. The modern aircraft jet engine, Mr. Samuely said, makes heavy demands on grinding capacities. Unmachinable except for grinding and intricate of profile or pattern, many parts in the high temperature zone of these engines are singularly reliant on crush form grinding wheels for faithful reproduction on a high output basis.

Student guidance, new subjects and the prospect of a junior high school with condensed courses for those unable to take advantage of a full high school curriculum left most of the older members feeling that they had been born 30 years too soon. These features were among "Modern Trends in Education" reported by Clarence Bulmer, technical director of Delta Secondary School.

Today's educational system is flexible, Mr. Bulmer added, adapting itself to the student's needs and capabilities.

The Nominating Committee's slate of candidates for chapter office were voted in by acclamation. Those elected are: J. E. R. Yorick, chairman; W. M. Shaw, first vice-chairman; H. J. Millett, second vice-chairman; J. M. Snyder, third vice-chairman; D. V. Roland, secretary, and R. I. Hall, treasurer.

SAN FRANCISCO, CALIF.—Golden Gate members went to the polls February 21 while meeting at Red Coach Restaurant, Oakland.

Ben G. Berlien was elected chairman, along with Ted J. Rohrer, first vice-chairman; David Gustafson, second vice-chairman; Jack E. Moeller, secretary, and Dean Rouland, treasurer.

Guest speaker was Paul F. Rehner of the Carbide Alloys Div., Allegheny Ludlum Steel Co., Detroit. Mr. Rehner spoke on "Evolution of Die Materials" and "Applying Tungsten Carbide to Die and Wear Parts" to an audience of approximately 100 members and guests.

PEORIA, ILL.—Despite inclement weather and icy roads, 161 members of Peoria chapter turned out to elect new officers, February 6. The dinner meeting took place at the American Syrian Society Clubhouse.

Candidates winning office are: Duane H. Brighton, chairman; William H. Logue, first vice-chairman; Don I. Hartter, second vice-chairman; Victor W. Schellschmidt, secretary; Walter Ballard, treasurer, and Robert W. Bayless, delegate.

In a farewell address Mr. Bayless, the retiring chairman, thanked the membership for their support and cooperation during his administration.

Elected to head up Peoria chapter are, from left, seated: William Logue, first vice-chairman; Duane Brighton, chairman; Don Hartter, second vice-chairman; standing: Walter Ballard, treasurer; Victor Schellschmidt, secretary, and Robert Bayless, delegate.

WICHITA, KANS.—Frank E. Holderby has been selected as the recipient of the chairman's award pin for Wichita chapter. The emblem was presented to Mr. Holderby by Chairman Emanuel Pitsch during the chapter's February 14 dinner meeting at Wolfe's Cafeteria. Mr. Holderby was chosen for the honor for obtaining 11 new members during the past year.

Dool Heads Officers

Officers elected for the coming season are: Hazen I. Dool, chairman; James Hill, first vice-chairman; Orville B. Strahm, second vice-chairman; James H. Janson, secretary, and Ambrose A. Reddy, treasurer.

Economies effected in eliminating machine operations through "Precision

More News on Page 90

Directory of A.S.T.E. Chapter Chairmen

AKRON, C-47
Third Monday*
A. O. Hunt, 124 N. Harmony St., Medina, O.

ATLANTA, C-61
Third Monday*
Clarence E. Redfern, Auto Soler Co., 267 Marietta St., N.W., Atlanta 3, Ga.

BALTIMORE, C-13
First Wednesday*
John W. Schukraft, 1213 E. Belvedere, Baltimore 12, Md.

BINGHAMTON, C-35
1st Wed. after 1st Mon.*
Donald L. Ellis, 97 Front St., Vestal, N.Y.

BOSTON, C-33
Second Thursday*
Prescott A. Smith, Mass. Inst. of Tech., 77 Massachusetts, Cambridge 39, Mass.

BUFFALO-NIAGARA FRONTIER, C-10
Second Wednesday*
Wilbur J. Reich, 1036 Town Line Rd., Lancaster, N.Y.

CEDAR RAPIDS, C-71
Third Wednesday*
W. D. Popek, 833 14th St., S.E., Cedar Rapids, Ia.

CENTRAL PENNSYLVANIA, C-22
First Monday*
David A. Schrom, 554 Pacific Ave., York, Pa.

CHICAGO, C-5
Second Tuesday*
Harold D. Long, 1901 S. Rockwell, Chicago 8, Ill.

CINCINNATI, C-21
Second Tuesday*
Edgar L. Routzong, 6131 Robison Rd., Cincinnati 13, O.

CLEVELAND, C-3
Second Friday*
R. C. Southwell, 2025 Belvoir Blvd., Cleveland 12, O.

COLUMBUS, C-36
Second Wednesday*
Milner D. Sherman, 2745 Camden Rd., Columbus 12, O.

DAYTON, C-18
Second Monday*
Lawrence R. McAfee, Peninsular Steel Co., 401 Kiser St., Dayton 4, O.

DECATUR, C-58
Last Tuesday*
James H. Clark, 1090 W. Tuttle, Decatur, Ill.

DENVER, C-77
First Wednesday*
Warren L. Foss, 930 S. Elizabeth, Denver 9, Colo.

DES MOINES, C-80
Third Wednesday*
Clyde Allen, 836 Douglas, Des Moines 13, Ia.

DETROIT, C-1
Second Thursday*
John D. Anderson, 13860 Fairmount Dr., Detroit 5, Mich.

ELMIRA, C-24
First Monday*
Henry G. Lemaire, RD 1, River Rd., Elmira, N.Y.

ERIE, C-62
First Tuesday*
Robert J. Wilson, Jr., 10 Henry St., Warren, Pa.

EVANSVILLE, C-73
Second Monday*
Charles H. Thuman, Seeger Refrigerator Co., 225 W. Morgan Ave., Evansville 7, Ind.

FAIRFIELD COUNTY, C-6
First Wednesday*
Douglas F. Linsley, 250 S. Compo Rd., Westport, Conn.

FOND DU LAC, C-45
Second Friday*
Charles Billberg, Wisc. Axle Div., 567 High St., Oshkosh, Wis.

FORT WAYNE, C-56
Second Wednesday*
Ralph J. Didier, 2501 Wayne Trace, Ft. Wayne 4, Ind.

FOX RIVER VALLEY, C-72
First Tuesday*
George Bodi, 519 Edwards St., Aurora, Ill.

GOLDEN GATE, C-28
Third Wednesday*
G. B. Berlien, Ind. Steel Treating, 600 Fallon St., Oakland, Calif.

GRAND RIVER VALLEY, C-81
Third Tuesday*
Harry J. Sehl, Sehl Eng'g. Co., Kitchener, Ont., Can.

GRANITE STATE, C-86
Second Tuesday*
Charles M. Nystedt, 24 Meadow Rd., Durham, N.H.

HAMILTON, C-42
Second Friday*
J. E. R. Yorick, 105 Sterling St., Hamilton, Ont., Can.

HARTFORD, C-7
First Monday*
R. M. Toppin, Jacobs Mfg. Co., W. Hartford, Conn.

HOUSTON, C-29
Second Tuesday*
Robert E. Schuller, 7024 Avenue N., Houston 11, Texas

INDIANAPOLIS, C-37
First Thursday*
Ernest W. Hilkenbach, 2433 N. Illinois St., Indianapolis 8, Ind.

JACKSON, C-87
Frank E. Gokay, Teer, Wickwire & Co., Jackson, Mich.

KANSAS CITY, C-57
First Wednesday*
Ivan J. Nelson, 2239 Garfield Ave., Kansas City 2, Kans.

LEHIGH VALLEY, C-83
Third Friday*
James R. Fairhurst, 91 Harte, Phillipsburg, N.J.

LITTLE RHODY, C-53
First Thursday*
C. B. George, 276 Niantic Ave., Providence 7, R.I.

LONG BEACH, C-84
Second Wednesday*
William B. Mackay, 260½ Glendora Ave., Long Beach 3, Calif.

LONG ISLAND, C-88
Henry Maehl, Fairchild Engine Div., Conklin Ave., Farmingdale, L.I., N.Y.

LOS ANGELES, C-27
Second Thursday*
G. J. Walkey, 1524 Pepper St., Burbank, Calif.

LOUISVILLE, C-54
Second Wednesday*
W. D. Wuest, 916 Greenleaf Rd., Louisville 13, Ky.

MADISON, C-75
1st Tues. after 1st Mon.*
A. G. Hoffer, Gisholt Mach. Co., 1245 E. Washington, Madison 10, Wis.

MID-HUDSON, C-74
Second Tuesday*
William W. Schug, 8 Janis St., R.D. 2, Hudson, N.Y.

MILWAUKEE, C-4
Second Thursday*
Walter O. Behrend, 2817 N. 48th St., Milwaukee 10, Wis.

MOHAWK VALLEY, C-78
Fourth Tuesday
Arnold K. Schroeder, 2810 Leibel Pl., Utica 3, N.Y.

MONTREAL, C-50
Second Thursday*
J. P. Cloutier, 5035 Ontario E., Montreal, Que., Can.

MUNCIE, C-70
First Tuesday*
H. L. Mendenhall, N. Tillotson Ave., RFD 7, Muncie, Ind.

NASHVILLE, C-43
Third Tuesday*
A. Scobey Rogers, Jr., 2808 Westwood Ave., Nashville, Tenn.

NEW HAVEN, C-41
Second Thursday*
David J. Mathewson, Mathewson Tool Co., 28 Richards St., West Haven, Conn.

NEW YORK, GREATER, C-34
First Monday*
Joseph P. Schneider, 576 73rd St., Brooklyn 9, N.Y.

NIAGARA DISTRICT, C-65
First Thursday*
F. W. Dunn, 366 Church Rd., RR 5, St. Catharines, Ont., Can.

NORTH TEXAS, C-51
Last Friday*
John K. Turvene, 3003 Aster St., Dallas 11, Texas

NORTHERN NEW JERSEY, C-14
Second Tuesday*
James Allan, 285 Munroe Ave., Wyckoff, N.J.

PEORIA, C-31
First Tuesday*
Duane H. Brighton, 125 S. Eleanor, Peoria, Ill.

PHILADELPHIA, C-15
Third Thursday*
Willard J. Griffith, Ritterhouse Rd., Fairview Village, Pa.

PIEDMONT, C-82
Second Monday*
A. F. Moosbrugger, 14 F College Village, Winston Salem 5, N.C.

PITTSBURGH, C-8
First Friday*
W. J. Bickmore, 3942 Forbes St., Pittsburgh, Pa.

PONTIAC, C-69
Third Thursday*
John M. Fritcher, 933 Cameron Ave., Pontiac 17, Mich.

PORTLAND (ME.), C-46
Second Friday*
Carl A. Snow, 502 Deering Ave., Portland 5, Me.

PORTLAND (ORE.), C-63
Last Thursday*
Walter L. Brenneke, 2434 N. E. 21st Ave., Portland 12, Ore.

POTOMAC, C-48
1st Thurs. after 1st Mon.*
B. E. Thomasson, 4900 13th St., N., Arlington, Va.

RACINE, C-2
First Monday*
George S. Strombeck, Racine School of Voc. Adult Educ., 800 Center St., Racine, Wis.

RICHMOND, C-66
Second Tuesday*
Dezell Gibbs, Perfect Circle Corp., 522 S. Washington, Hagerstown, Ind.

ROCHESTER, C-16
First Monday*
James O. Horne, 212 Powers Bldg., Rochester 14, N.Y.

ROCKFORD, C-12
First Wednesday*
George P. Torrence, Jr., Ingersoll Milling Mach. Co., Rockford, Ill.

SAGINAW VALLEY, C-68
Third Thursday*
Russell M. Ayers, 3410 Gratiot, Flint 3, Mich.

ST. LOUIS, C-17
First Thursday*
L. W. Greenblatt, Jr., 7814 Maplewood Ind. Ct., St. Louis 17, Mo.

SALT LAKE CITY, C-85
1st Fri. after 1st Wed.*
Leslie C. Seager, 1194 Crystal Ave., Salt Lake City 6, Utah

SAN DIEGO, C-44
Second Tuesday*
A. P. Manino, 4816 Federal Blvd., San Diego 2, Calif.

SCHENECTADY, C-20
Second Tuesday*
Benjamin E. Storrs, 377 Wallace St., Scotia 2, N.Y.

SEATTLE, C-39
Fourth Tuesday*
Francis L. Coenen, 400 W. Mercer St., Seattle 99, Wash.

SOUTH BEND, C-30
Second Tuesday*
H. A. Goltz, 1206 Portage Ave., South Bend, Ind.

SPRINGFIELD (ILL.), C-64
First Tuesday*
Roger W. Wallace, 1930 N. 6th St., Springfield, Ill.

SPRINGFIELD (OHIO), C-76
Fourth Thursday*
Eldon M. Neff, 1515 Maryland Ave., Springfield 20, O.

SPRINGFIELD (MASS.), C-32
Second Monday*
Jason G. Doubleday, North Rd., Hampden, Mass.

SYRACUSE, C-19
Second Tuesday*
Carl J. Hoffman, 21 Reed Parkway, Marcellus, N.Y.

TOLEDO, C-9
Second Wednesday*
Dale H. Burke, 4238 N. Lockwood Ave., Toledo 12, O.

TORONTO, C-26
First Wednesday*
Douglas R. Cooper, Can. Fairbanks Morse Co., 137 Harbour St., Toronto, Ont., Can.

TRI-CITIES, C-23
Second Wednesday*
Joseph Zelnio, 421 11th St., Moline, Ill.

TWIN CITIES, C-11
First Wednesday*
Peter S. Tobias, 4451 5th St., N.E., Minneapolis, Minn.

TWIN STATES, C-40
Second Wednesday*
Floyd J. McArthur, 2 Circular St., Springfield, Vt.

WATERLOO AREA, C-79
Last Wednesday*
James A. McCollum, 2015 Highland Dr., Ann Arbor, Mich.

WESTERN MICHIGAN, C-38
Second Monday*
Claude C. Hanish, 420 Elliott S.E., Grand Rapids, Mich.

WICHITA, C-52
Second Wednesday*
Hazen I. Dool, 847 Marcilene, Wichita 17, Kans.

WILLIAMSPORT, C-49
Second Monday*
Richard S. Huskin, 808 Lincoln Ave., Williamsport 31, Pa.

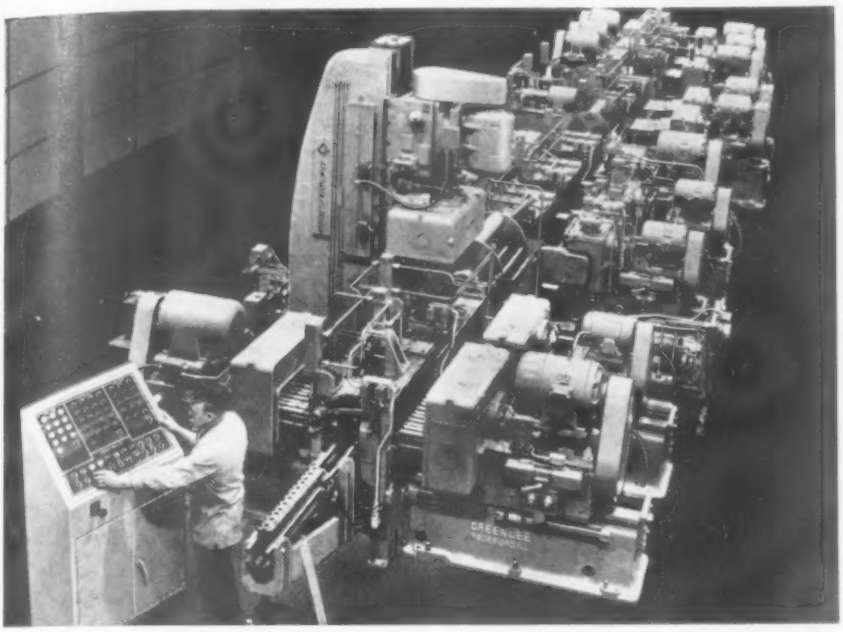
WINDSOR, C-55
Second Monday*
H. J. A. Chambers, Std. Mach. & Tool Co., 870 Ottawa St., Windsor, Ont., Can.

WORCESTER, C-25
First Tuesday*
Ralph A. Baker, Whitin Machine Wks., Whitinsville, Mass.

*Meeting Night

Tools of Today . . . .

High Production with Transfer-Type Machine



Illustrated is a 15-station, 66 foot long transfer machine, built by Greenlee Brothers & Company, Rockford, Ill., which completes 251 operations on the top, bottom, manifold side and ends of automotive cylinder heads at a production rate stated as 77 heads machined per hour. All operations are completed in cycle time of 37.2 seconds.

Turnover fixtures, which rotate the work 360 deg, are installed in the fourth and seventh stations to remove chips which accumulate within the workpiece during the machining operations. These stations also serve as inspection stations.

The right-hand unit in the sixth station contains two heads that move in and then cross feed to perform two drilling and countersinking operations on the back end of the work, and a boring and chamfering operation on the front end. The right hand unit in the fifth station contains a retractable spindle for milling a pad on the back end of the workpiece. **T-5-731**

Vertical Milling Machine

Significant improvements are claimed for the No. 4 "Electronic" vertical milling machine manufactured by Reed-Prentice Corp. Formerly available only in 48 in. capacity, this miller is now offered in both 48 and 60 in. capacities, the latter model offering a working surface of 24 x 96 in. as against the 24 x 84 in. working surface of the 48 in. model.

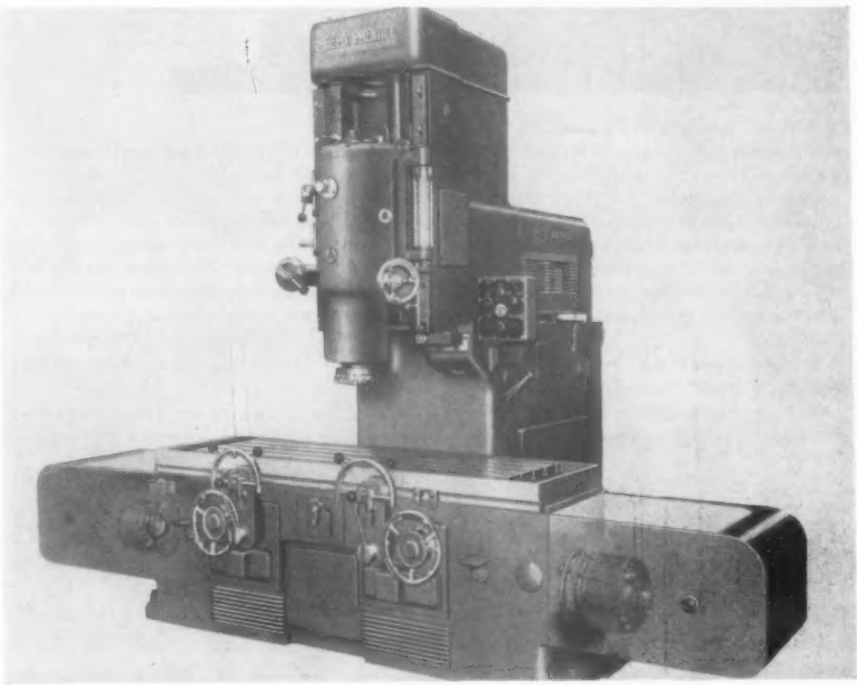
Designed for heavy-duty milling and die sinking operations, the No. 4 miller features "electronic" control for all feeds through a master control station containing spindle start, stop, and jog push buttons; dials for controlling speeds of table, cross slide and vertical slide; selector switch for the two slides; and emergency master stop push button.

Centralized operating levers are within easy reach. Table and cross slides have identical control systems with each consisting of an airplane type half-handwheel and a 5-position ball grip lever. The former gives an infinitely variable feed rate in either direction, and the ball grip lever provides feed and rapid traverse in either direction.

Two 3 HP AC motors—one for the table and one for the cross slide—power the rapid traverse motion which, incidentally has been increased in both the 48 and 60 in. models to 180 in. per minute. The feed rate is constant, pre-selected and controlled by the position of potentiometers located on the push button station.

The spindle, driven by a 10 HP 1200 rpm motor, is reversible, and electrical interlocks and positive mechanical means safeguard against faulty operations. Three 1½ HP motors, with electronic control to provide infinitely variable feed rates, drive the table, cross slide and vertical slide. Range of drives is from ½ to 25 in. per minute.

Full details contained in an illustrated circular available from Reed-Prentice Corp., Dept. TE, 677 Cambridge St., Worcester 4, Mass. **T-5-732**

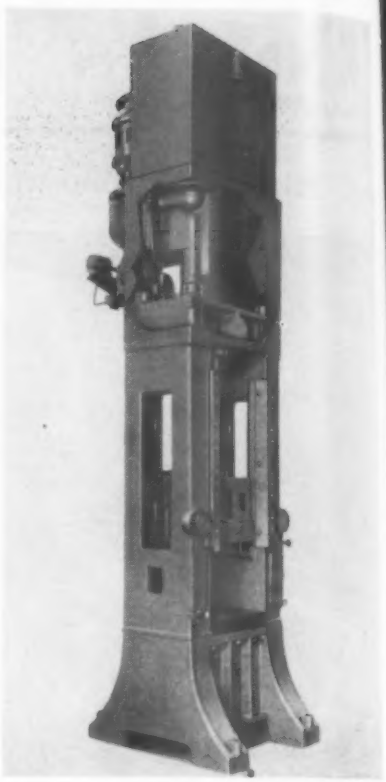


"Pipeless" Presses

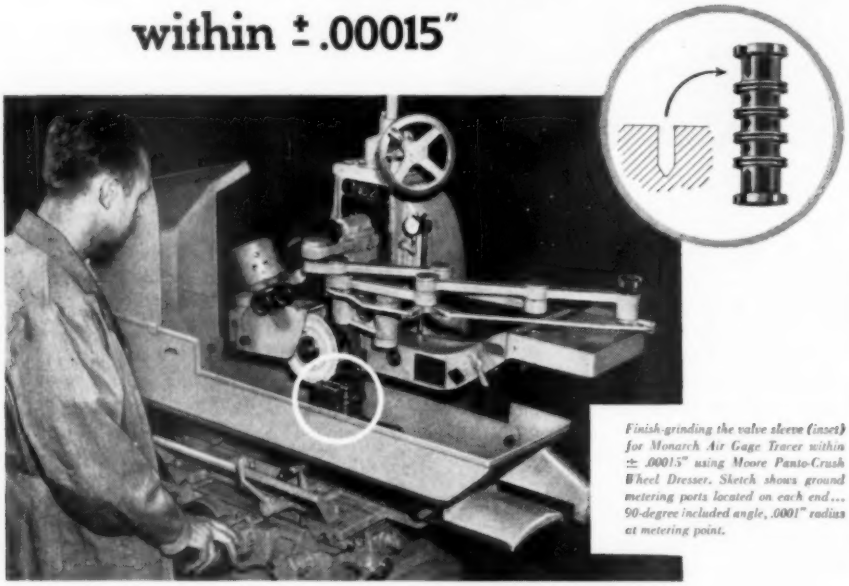
Announced by the Elmes Engineering Div. of American Steel Foundries, Cincinnati 29, Ohio, is a hydraulic press so designed that there is no piping in the main hydraulic circuit. The only pipes in the entire press are the pilot, suction and drain lines, and of these only the pilot line carries high pressure. Otherwise, all high-pressure fluid is conducted through short passages drilled in the structural parts; thus, there are no screwed or welded joints to break loose and cause leakage.

The novel principle of construction further provides smooth and shockless operation and virtually eliminates destructive vibration. It is also conducive to simple and therefore economical maintenance. Pumping units and valve groups fit standard bolting and drilling layouts, providing a variety of pumping arrangements, and both groups may be removed as unit assemblies without disconnecting any piping.

Aside from the pipeless principle, these presses have the same construction and operating features as other Elmes hydraulic presses. Among these are pushbutton control, pressure and stroke reversal, no hesitation of platen on position slowdown and, as previously stated, shockless operation. Complete details may be had from the manufacturer. **T-5-741**



Moore Wheel Dresser Keeps Monarch Air Gage Tracer Part within ± .00015"



Finish-grinding the valve sleeve (inset) for Monarch Air Gage Tracer within ± .00015" using Moore Panto-Crush Wheel Dresser. Sketch shows ground metering ports located on each end... 90-degree included angle, .0001" radius at metering point.

1951's machine tools produce with unprecedented speed and accuracy because advanced tools fabricate their complex new operating features.

Take tracer-controlled duplication machining, pioneered by the Monarch Machine Tool Co. of Sidney, Ohio. Every component of the Air Gage tracer hydraulic valve for Monarch lathes is completed to tolerances ranging from .0001" to .0003" in what Monarch employees call their "Tenths Room."

An important part of this room is the Moore Panto-Crush Wheel Dresser*. Mounted on a surface grinder, it makes possible the finish-grinding of the metering ports on each end of the valve sleeve. These ports have a 90-degree included angle with a ten-thousandths radius at the metering point. Depth must be held to plus or minus .00015".

No other method could accomplish this as quickly and accurately as the Panto-Crush Wheel Dresser. This unit *combines* crush-forming and diamond dressing. Either method is immediately available. Switching from one to another disturbs neither the work-setting nor the location of either truing device with respect to the wheel or workpiece.

Ask for literature describing the device in detail, including reprints of articles appearing in technical magazines.

*Another is a Moore Jig Borer.

MOORE SPECIAL TOOL COMPANY, INC.
732 UNION AVENUE, BRIDGEPORT 7, CONNECTICUT

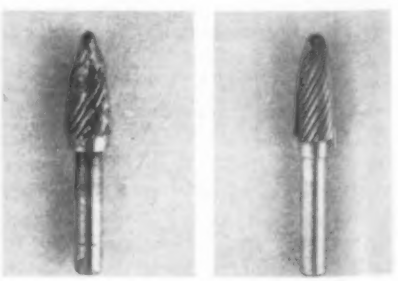
ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-74

Tool Conservation

Entirely aside from manufacture of their carbide midget mills and burs, Severance Tool Industries, 728 Iowa St., Saginaw, Mich., invites consideration of their facilities for reconditioning used or damaged tools by regrinding and repairing—as, for example, the "before and after" of the reconditioned tool illustrated.



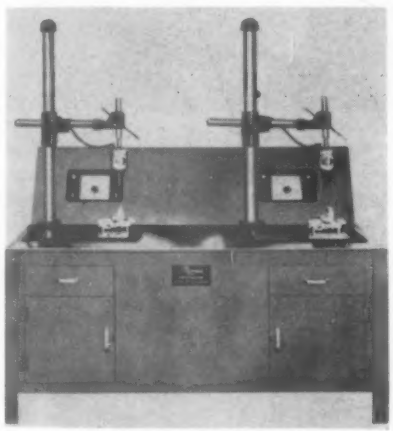
This service is particularly timely in view of the current need for conserving carbide products, and Severance states that dull or broken tools can be reworked so as to give original performance, the only consideration being a slight reduction in size. **T-5-742**

Granite Surface Plate

A precision surface plate, made of black granite and with a claimed accuracy of 50 millionths of an inch has been developed by Collins Granite Surface Plate Co., 1331 Santa Fe Ave., Los Angeles 21, Calif. Being non-magnetic and having a surface said to be harder than tool steel, it is non-deflecting, non-glaring, and requires no oiling.

Known as "Micro-Flat," this surface plate is a precision tool that provides an ultra-smooth surface for layout and inspection. It is available in sizes from 9 x 12 in. to 54 x 108 in., and promises unlimited life at a cost claimed by the manufacturer to be less than that of a scraped cast iron plate. **T-5-751**

Metal Disintegrator

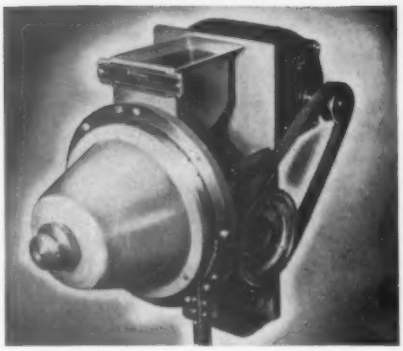


The twin Thomas "Metalmaster" metal disintegrator, here shown, is designed for installation at a key point of a conveyor line. Parts containing broken taps are moved to each end of the twin disintegrator—on rollers, if heavy, such as motor blocks—and may be handled by one operator so that one unit is being loaded and positioned while the other removes the broken taps. Manufactured by the Warner Div. of Clinton Machine Co., 21535 Grosbeck Rd., Detroit 5, Mich. **T-5-752**

Automatic Rivet Feed

Announced by Feedall Machine & Engineering Co., 29 Elm St., Willoughby, Ohio, is an automatic feeder—Model 300—designed for feeding of small rivets, screws, eyelets and other parts that lend themselves to selective feeding.

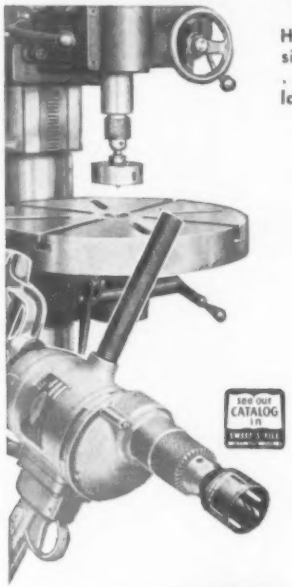
The unit, which is designed for easy mounting on or adjacent to a machine, is especially suited to feeding parts to power screw drivers and to presses for riveting or assembly operations. Feeding mechanism is based on the rotating selector ring principle, and parts oriented in the proper position pass to the work station via chute. Parts not initially positioned recirculate. **T-5-753**



Cut...

LARGE HOLES

... thru any machineable material up to 1⅛ INCHES thick!



Here is a premium tool which makes it possible to saw holes in one short operation ... large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

MARVEL High Speed-Edge Hole Saws come in 35 sizes, from ⅜" to 4½". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-650

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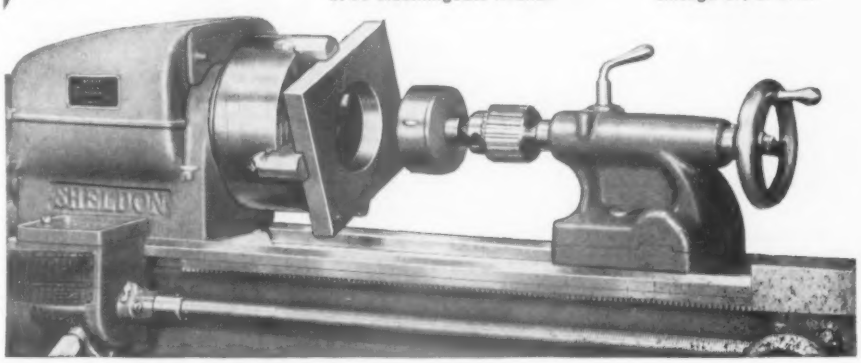
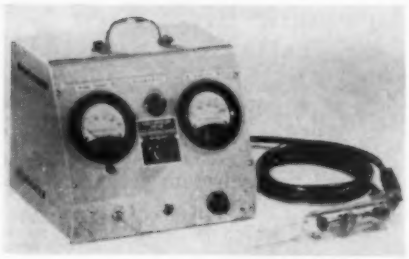


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-75

USE READER SERVICE CARD ON PAGE 97 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Leak Detector

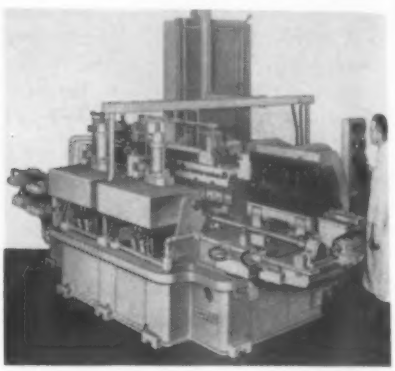
Model LD-01 Leak Detector, by Distillation Products Industries Div., Eastman Kodak Co., Rochester, N. Y., operates on the principle that the tendency of hot platinum to emit positive ions is enormously stimulated by almost infinitesimal traces of halogens or their compounds. It may be applied to establish presence of leaks too small to be detected by more obvious signs.



In operation, the glass sensitive tube of the leak detector is sealed into the system under test, and the system is then pumped down to a moderate vacuum. A jet of harmless Freon gas—or other halogen-containing gas—is then directed against portions of the system suspected of leaking. When the jet strikes a leak, the gas enters the system and, instantly increasing the ability of a hot platinum anode in the tube to emit positive ions, causes a sudden deflection of the meter needle on the instrument face. T-5-761

Line Transfer Machine

A special-purpose, 5-station, line transfer machine designed to drill the main bearing cap holes and to drill, ream and chamfer the master dowel holes in cast iron, valve-in-head cylinder blocks has been introduced by Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Mich. Operation is automatic after loading, and automatic hydraulic clamping is provided at each station. The entire operation is said to require but 36 seconds, giving a production ratio of 80 pieces an hour at 80 percent efficiency. The machine is designed for operation by unskilled labor.



Progress through the stations is as follows: 1, load and turn the part through 90 deg, bringing the bottom face to the right; 2, drill 10 holes of various sizes; 3, ream and chamfer two holes; 4, turn the part 90 deg, bringing the bottom face down. Sta. 5, transfer block to conveyor. Hydraulically operated, counterweighted brackets turn the part 90 deg at the loading and unloading station so that it enters and leaves the machine on the bottom face and transfers through the machine on its side.

High speed steel tools revolving at 80 sfpm with feed of 0.099 in. for drilling, and 55 sfpm with feed of 0.015 in. for reaming. Unit stroke is 14.25 in. Two standard Snyder guide bar units are used. Drive is by motors through coupling to spur gears, using one 7½ HP motor for the drilling operation, one 2 HP motor for the reaming operation, and one 10 HP motor for the hydraulic unit. Indexing mechanism is hydraulic transfer type, and lubrication is automatic through a central system. Base and column construction is heavy, welded steel plate thoroughly normalized and braced for rigidity. T-5-762

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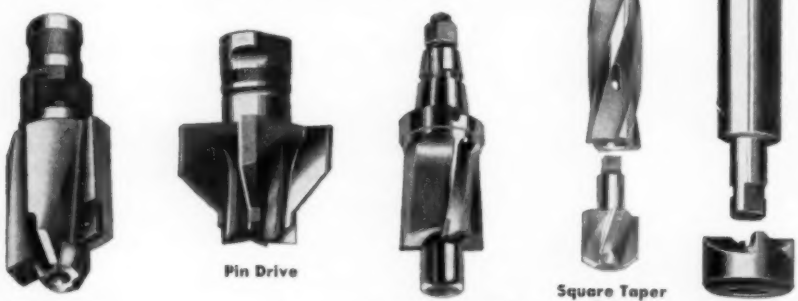

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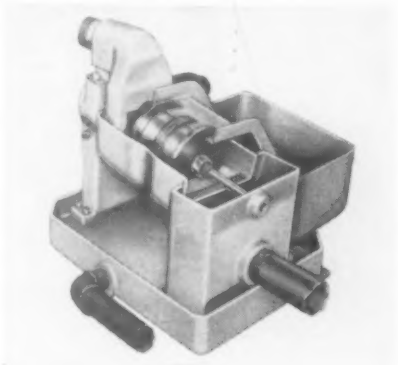
Diamond Wheel Dresser

A diamond-pointed abrasive wheel dresser—the Habit Index-A-Point—is now offered exclusively in the United States by Anton Smit & Co., 333 W. 52nd St., New York, N. Y. A simple but positive method of rotating the diamond through a sequence of seven stations, thereby presenting a sharp point to the wheel at each station, is said to lengthen the life of the diamond by 1/3 and to reduce diamond resetting to as little as 1/10. It is further said to improve finish and to increase productivity. **T-5-771**

Magnetic Clarifier

The Houdaille Magnetic Clarifier, introduced by the Honan-Crane Corp., 767 Wabash Ave., Lebanon, Ind., is said to remove 98 percent of contaminants from liquid coolants and to provide continuous delivery of clean coolant to the machine sump for re-use. The unit is designed for individual application on metal cutting machine tools.

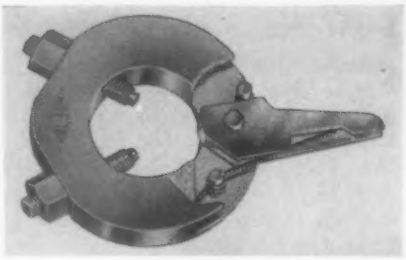


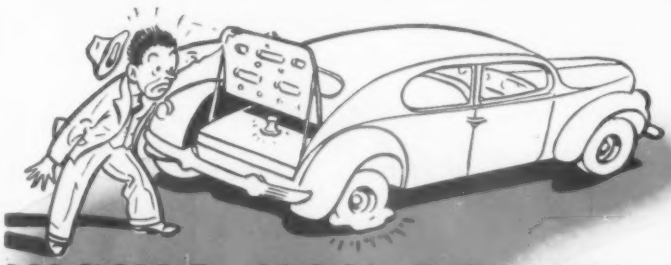
Removal of metallic and abrasive particles is accomplished by use of permanent ring magnets completely enclosed in a non-magnetic cylinder which seals off the magnetic cores from the fluid. This design provides a full 360 deg field of constant magnetic attraction. Rated at 20 gpm and completely automatic, the clarifier operates on a 1/12 hp 60 cycle 110 V motor. The unit measures 22-4/8 x 15-3/16 x 16½ in. high. **T-5-772**

Cam Action Dog

Claimed for the "Cam Action" grinder and lathe dog, by the Ready Tool Co., 550 Iranistan Ave., Bridgeport, Conn., is time and cost saving due to increased efficiency, particularly on semi-automatics and when there is comparatively little traverse feed. The dogs are easy to adjust, and action is rapid and positive; the harder the drive, the tighter the grip.

The cam is finished smooth for grinders, to prevent marring of work surfaces, and serrated for lathes, to prevent slippage. The dogs are further available with brass cam and screws for grinder application. Sizes range from ⅛ up to 6 in. capacities. **T-5-773**





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A machine shop foreman may be in a worse predicament without a spare arbor. When an arbor breaks, production ceases until the arbor is replaced. Machine and manpower hours wasted! Schedules disrupted! Deliveries delayed! That's why we say —

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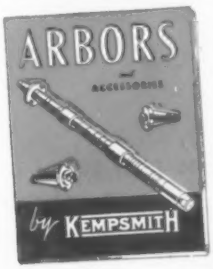

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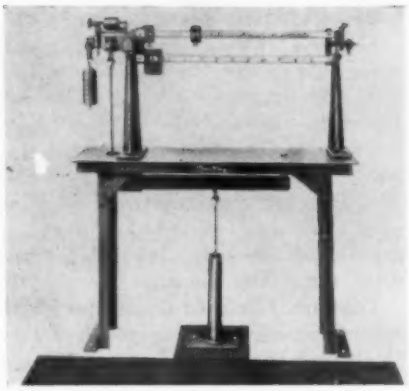
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-77

Platform Scale

A platform beam scale designed for fast, accurate low-cost industrial weighing applications, is announced by The Yale & Towne Mfg. Co., Philadelphia Div., 11000 Roosevelt Blvd., Philadelphia 15, Pa. Called the Load King, this scale is designed primarily for heavy-duty industrial applications where "shock-loading" is the rule. The lever system in the platform is all-steel, as are other key parts. No wood is used throughout.

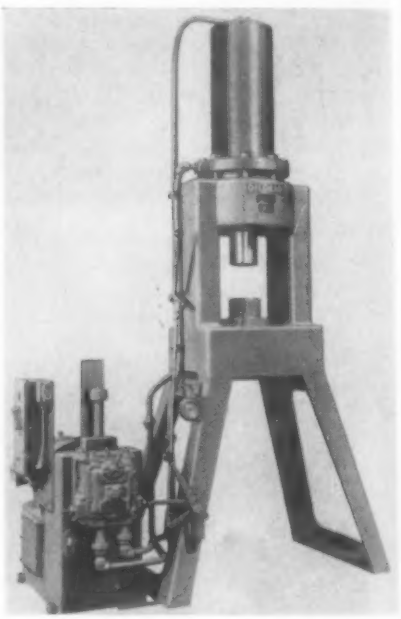


Poises on the main bar are mounted on roller bearings for rapid positioning. Other features include a 100 percent end-loading platform said to give the same reading regardless of the location of the load on the platform which, mounted on outboard bearings, also absorbs the shock of moving loads without damage to the scale. It will not tip.

Pit requirements are only 11 in., saving considerable expenditure on excavation when the scale is installed. Available in self-contained and semi-self contained models, the scale is built in capacities up to 6,400 pounds. Platforms range from 46 x 38 to 76 x 54 in. **T-5-781**

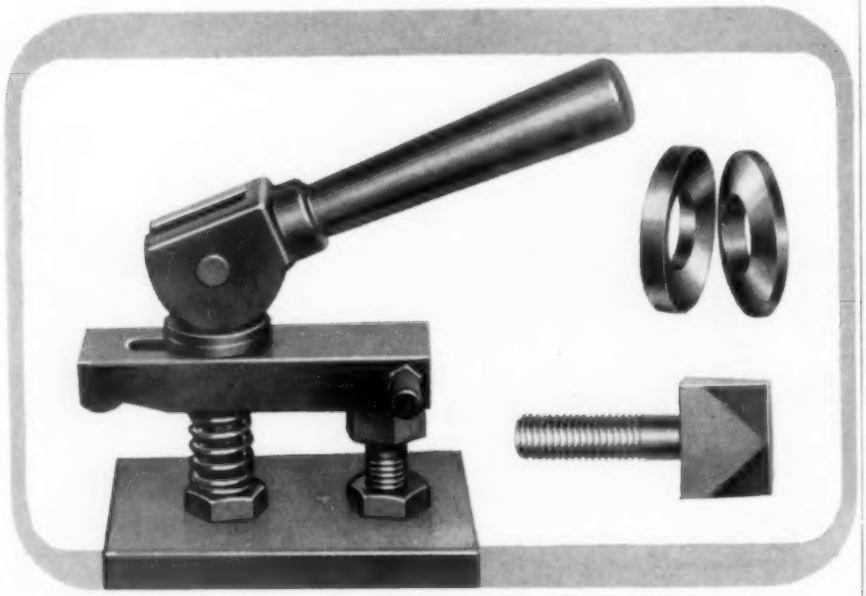
Ceramics Extruder

While designed for extruding ceramics, a 50-ton special vertical press by the Oilgear Co., 1585A West Pierce St., Milwaukee 4, Wis., is also suited for extrusion of graphite, pencil leads and similar products. The table is 60 in. high to accommodate a receptacle for the extruded product, and an oilgear pump unit provides both the necessary variable ram speeds and the rapid closing and return speeds required to cut down cycle time and congealing of materials.



Dual hand levers control the press ram through a common linkage. Tripping to rapid traverse brings the ram down, at 58 ipm, until it reaches the extrusion cylinder. A lever is then tripped to feed position, when the ram advances at speeds variable from 0.07 to 2.5 ipm. Return speed is at 64 ipm. Stroke of the ram is 26½ in., daylight 18½ x 18 in. between columns. **T-5-782**

USE READER SERVICE CARD ON PAGE 97 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION



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With Lodding Details and Clamp Assemblies real savings begin in the engineering department. You will not only save time from the designing and drawing of special fixtures, but in your tool room expensive labor can be turned to other advantages when Lodding parts are used.

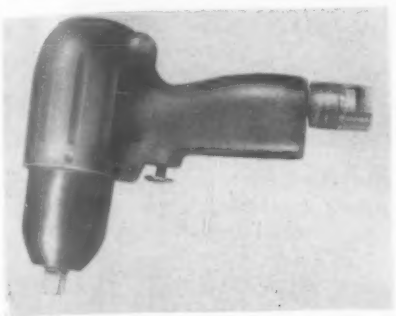
Catalog and Tracing Templates, on request.

LODDING, Inc.
WORCESTER, MASS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-78

Impact Wrench

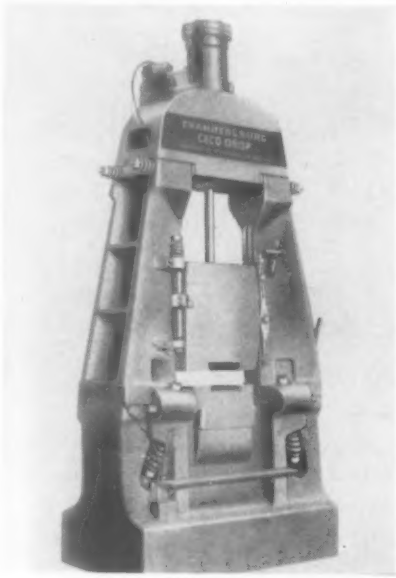
A pneumatic impact wrench incorporating a simplified mechanism is announced by the Master Pneumatic Tool Co., Orwell, Ohio. Used for both driving and removing nuts, studs and screws in all types of assembly and sub-assembly, this tool is rated for 3/8 in. bolt size capacity on most work.



There are only two impacting parts, and the unit does not contain springs or gears. Impacting occurs only when the nut or stud begins to tighten, and the reverse valve is readily accessible to the user's thumb. The tool, which weighs approximately 5¼ lbs. and operates on 80-100 psi air pressure, is designed for production nut and stud setting. **T-5-791**

Ceco Drop Hammer

Chambersburg Engineering Co., Chambersburg, Pa., announces Model "C" Ceco-Drop, a piston-lift, gravity-drop hammer incorporating short, snappy strokes to provide fast and accurate production of cutlery, jewelry, hollow ware and silverware. Because such work entails recurrent wiping or polishing of the die, the machine has a safety rest which may be swung under the ram when elevated. **T-5-792**



Lathe Attachment

Du-Ona-Lathe is a rotary attachment, for lathes, designed to permit accurate jig boring, spaced drilling and reaming, fly cutting, facing, milling and other operations on jig and fixture components. While designed for mounting on the cross slide of a lathe, it may also be mounted on milling machines and surface grinders for forming of polygonal and odd shaped punches. It is particularly applicable for mounting on 9 in. South Bend Lathes, and models are available for other makes of 9 and 10 in. lathes. Illustrated brochure

available from the maker, Allan Mfg. Co., 22-76 Stainway St., Long Island City 5, N. Y. **T-5-793**

THE TRUMBULL ELECTRIC HAS INCREASED PRODUCTION OF THESE COPPER CONTACTS FROM 200 OR LESS, TO OVER 12,000 PER GRIND - - -

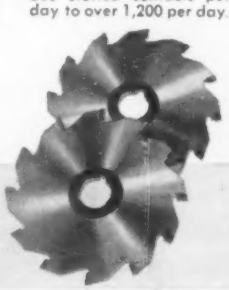
The Trumbull Electric Company has eliminated a troublesome production bottle-neck by adopting NELCO Carbide Cutters. Slotting copper contacts, a vital component of electrical switches carrying up to 600 Amperes, is a precision milling operation. Smooth, accurate cuts are as necessary as steady, dependable production. The change to NELCO Carbide Milling Cutters has not only resulted in amazing slotting operation output but has made possible substantial dollars and cents savings by practically eliminating down-time.

PRODUCTION RECORD —

HIGH SPEED STEEL CUTTER—from 30 to 200 pieces per grind.

NELCO CARBIDE CUTTER—from 6,000 to 13,000 pieces per grind.

A normal increase from 300 slotted contacts per day to over 1,200 per day.



WRITE FOR CATALOG "CARBIDE TOOLS," TODAY!

NELCO TOOLS

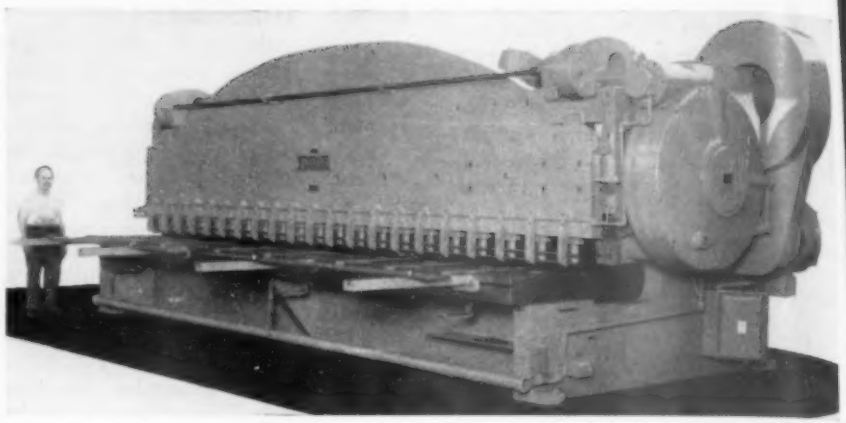
For that Extra Edge in Production

NELCO TOOL CO. INC. • MANCHESTER, CONN.

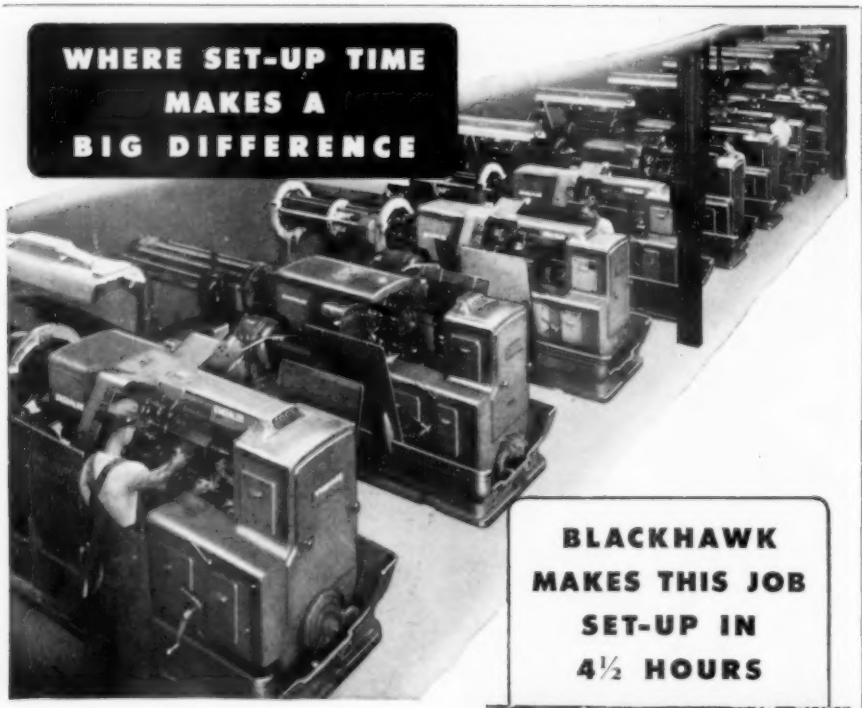
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-79

Large Capacity Shear

A Cincinnati shear with a capacity of 20 ft of ½ in. mild steel plate has been added to the line of "All-Steel" squaring shears manufactured by The Cincinnati Shaper Company, Cincinnati, Ohio. Weighing over 135,000 lbs., this shear has a speed of 20 strokes per minute and is equipped with hydraulic holddowns said to be capable of exerting a holding force of over 70 tons.



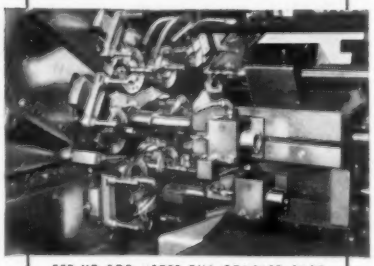
The holddown pistons are made with automobile type piston rings for long life and have a unique vacuum pump arrangement designed to prevent leakage of hydraulic oil. The shear has a 24 in. throat or gap and a 48 in. back gage range. Standard equipment includes four edge high-carbon tool steel knives with straight sides, and a section measuring 1¾ x 6½ in., ball bearing back gage with graduated dials; automatic lubrication; hinged angle and complete guarding. **T-5-801**



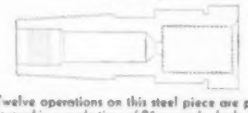
BLACKHAWK MAKES THIS JOB SET-UP IN 4½ HOURS

To be profitably accomplished, small-lot production on multiple-spindle screw machines requires a minimum of set-up time. Greenlee Automatics were especially designed for rapid machine changes to accommodate small-lot work.

The Blackhawk Mfg. Co., of Milwaukee, manufacturers of hydraulic jacks, bending equipment, tools, and fittings, find Greenlee Automatics well-suited for their critical production requirements. They like the Greenlee's easily-changed forming slide cams, rapid stroke-setting arrangement, and interchangeable tooling facilities, finding these and other features ideal for making profitable runs of 10,000 or more pieces. Properly-tooled Greenlee Automatics can solve your production problems, whether your job runs are large or small. Why not submit *part prints for cost-saving recommendations?*



SET-UP FOR "SPEE-D" COUPLER PART
® T. M. Reg. U. S. Pat. Off.



Twelve operations on this steel piece are performed in a cycle time of 21 seconds. Included are forming and shaving to close tolerances, facing, turning, and undercutting, accurate deep drilling, threading, and tapping. Set-up time is 4-1/2 hours. Only one tool change is needed on a 10,000 run.

PRODUCTION MACHINERY
GREENLEE

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MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

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HEPWORTH MACHINE TOOL COMPANY
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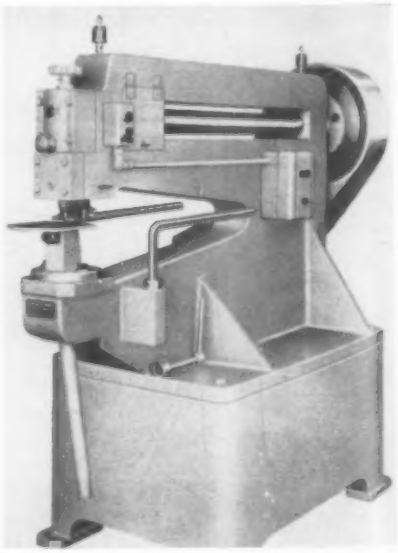
DAWSON MACHINERY COMPANY
5700-4 First Avenue, South
Seattle 8, Washington

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-80

Nibbling Machines

A line of nibbling machines, by Campbell Machine Div. of American Chain & Cable Co., Inc., Bridgeport, Conn., is designed to cut odd shapes of ferrous and non-ferrous metals at a considerable saving over drilling and filing. Because the cut is made with a rapidly moving circular punch operating over a circular die, the work may be fed with equal ease in any direction.



Shown is model 430, which has a throat depth of 30 in. and cuts mild steel up to ⅜ in. thick, corrosion-resistant steel up to ¼ in. thick. Other models range from 24 to 36 in. throat and are designed to cut metals from 3/16 to ½ in. thick. **T-5-802**

Special Contour-Matic

By combining some of their recently developed standard production units, the DoAll Company, Des Plaines, Ill., can now furnish machines for special applications—such, for example, as the Contour-matic here shown equipped with a 36 in. stroke heavy-duty hydraulic work table. This composite machine is used for precision machining of heat-resistant alloy components in jet engine production.

For this application, the machine's work height was increased and the standard 16 in. stroke tiltable table was replaced by the larger capacity table designed for fast, straight, perpendicular power-fed band sawing, slotting and grinding to close tolerances. **T-5-811**

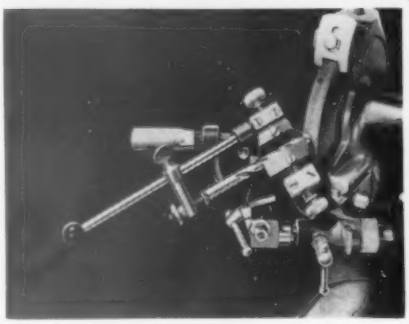
Solenoid Shut-off Valve

Announced by Airmatic Valve, Inc., 1643 E. 40th St., Cleveland, Ohio, is Model LDS-2-750, a direct solenoid 2-way capacity shut-off valve featuring positive seal, ports in-line, and only one moving part. Constructed of naval bronze, it is corrosion-resistant throughout, and may be applied for control of such fluids as oil, water or air. **T-5-812**

Sharpening Attachment

The Power Tool Division, Rockwell Manufacturing Co., Milwaukee 1, Wis., now offers a drill grinding attachment —No. 1296—for sharpening steel drills of any size from 1/8 to 5/8 in., using a standard tool grinder. A necessity for the inexperienced operator and a time saver for the expert mechanic, it is simple to operate and designed to produce correctly ground 2, 3, or 4-lip drills.

As assembled at the factory, the drill grinding attachment is arranged to produce the standard 118 deg lip angle with 12 to 15 degree heel or clearance angle. It is readily adjusted for other lip and clearance angles. **T-5-813**



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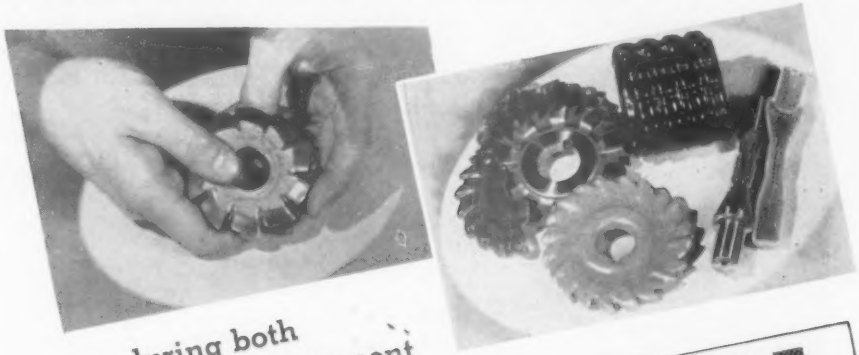

. . . during both manufacture and shipment with

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Prox-Peel — plastic packaging — protects and preserves through manufacturing processes — and during shipment. Prox-Peel applies a loosely adherent film by spraying, brushing, or dipping. There are two types — a molten and a solvent type. Both are used in Specification* requirements of Army, Navy, and Air Corps. There are hundreds of civilian uses. Prox-Peel, after protecting objects during manufacture and assembly, is peeled off — is frequently remelted or dissolved and re-used.

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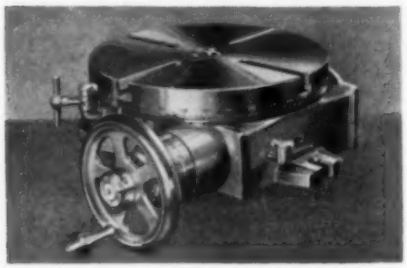
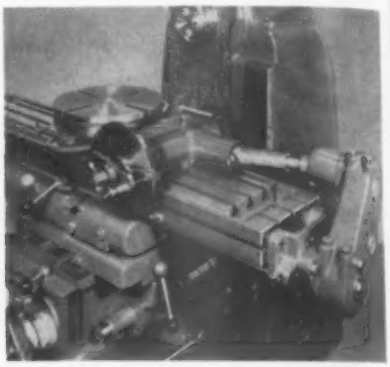
Rotary Attachment

A circular or rotary milling attachment, for use with their smaller knee-type milling machines, is announced by The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. While intended primarily for toolroom work, the unit becomes an efficient high-production unit for precision milling operations on small parts when properly tooled.



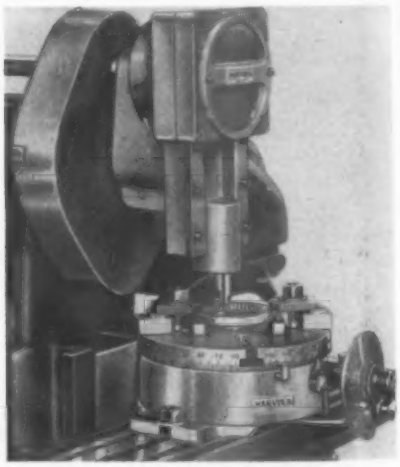
The attachment is built in two styles: manual feed, and power feed. For both styles, the table is 12 in. diameter, machined with four standard 9/16 in. T-slots, rotated through a worm and wheel having 80 to 1 ratio, and graduated in degrees on its circumference. The handwheel dial is graduated in minutes.

The power feed attachment is driven by the machine on which it is mounted. A shaft, beneath the table and parallel to the feed screw, drives a gear train within the bracket attached to the right-hand end of the table. Power is transmitted from the gear train to the attachment by a universal jointed, telescoping shaft. A reverse clutch arrangement permits the table to be driven clockwise or counter-clockwise, or disengaged for manual rotary adjustment. **T-5-821 A**



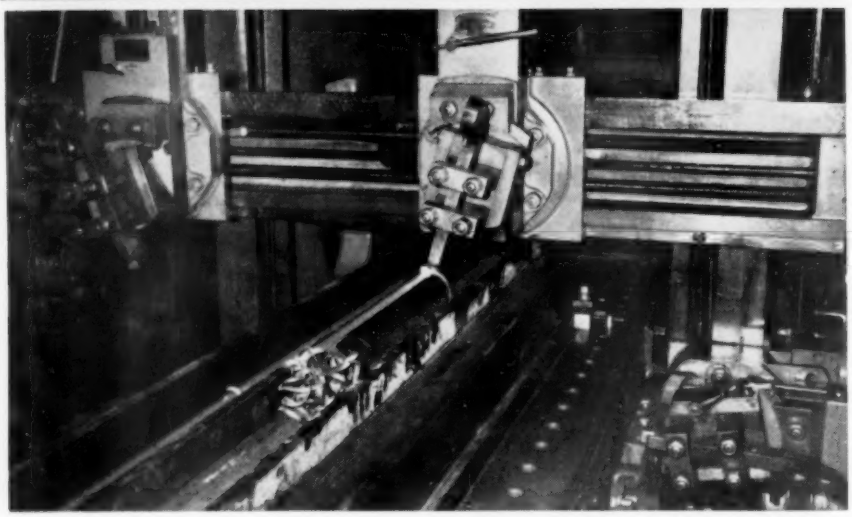
Both manual and power driven styles may be equipped with an auxiliary indexing attachment, the index plate of which is interchangeable with standard Cincinnati dividing heads. Complete information may be obtained by writing to the Cincinnati Milling Machine Co., publication No. M-1729. **T-5-821**

Slotting Attachment



A slotting attachment incorporating a positive drive, regardless of rate of speed, has been introduced by Marvin Machine Products, Inc., 414 Ford Bldg., Detroit 26, Mich. This tool is equipped with a roller chain which, as claimed by the maker, eliminates slippage and permits heavy cuts. Operator safety is provided by a hood mounted over the transmission. **T-5-822**

There's a Walker Magnetic Chuck for Every Known Application . . .



PRACTICAL DEMONSTRATION OF POWER

Walker Chuck, without supporting back rest, holds tremendous pressure.

Walker Chucks save setup time, eliminate need for costly and time-consuming clamps and work-holding fixtures.

Walker Chucks Also Permanent Type now available in the following sizes:

RECTANGULAR			SWIVEL	ROTARY
4″ x 8″	6″ x 18″	10″ x 15″	4″ x 8″	4″ 12″
5″ x 10″	8″ x 18″	10″ x 24″	6″ x 18″	6″ 14″
6″ x 12″	8″ x 24″	12″ x 24″	8″ x 24″	9″ 16″
				10″

Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

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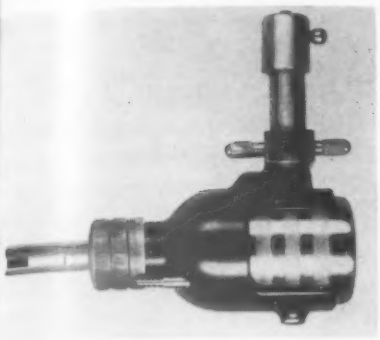
Portable Die Filer

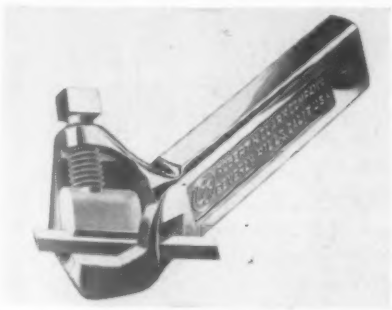


A lightweight, portable tool and die filing machine of Swedish manufacture —the "Diprofile"—is now available from Nord International Corporation, 50 Church St., New York 7, N. Y. A precision tool, operable by any 10,000 rpm controllable speed electric motor and having an adjustable stroke from 0 to ¼ in., it is applicable to a wide range of work, such as:

Filing, honing, polishing and lapping of internal and external surfaces; sharpening of carbide cutters and tips; and intricate profiling of tool and die components in addition to shaping parts for instruments and models. Diamond files, needle files and circular diamond saws are available or supplied as needed. **T-5-831**

Adjustable Tool Holder

The Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif., announces an adjustable tool holder having a vise-grip jaw designed to exert equal pressure over the full length of the cutter channel and to prevent rocking of the tool bit. The tool holders are further adjustable to handle general sizes of bits in squares, or rounds.



The vise-grip rigidly clamps short as well as long bits, also, narrow bits for cutting-off operations. Available in both standard 18 deg clamps and with parallel clamps for carbide bits, theading tools and boring bars. **T-5-832**

Collapsible Handling Box

Among the latest innovations in materials handling is the Hazen knockdown materials handling box which, with its nesting features and built-in safety, is said to exceed the stacking and strength features of rigid tote boxes. The assembled boxes are designed for safe interlocked stacking up to 6 tiers, while the collapsible feature implies that 10 disassembled units can be stored in a space ordinarily required for 4 assembled boxes.

The collapsible feature further reduces "shadow tonnage," whereby minimum freight rates are charged for loads of empty boxes regardless of weight. As claimed for the Hazen boxes, four normal freight car loads of filled boxes can, when empty and collapsed, be returned in one car. For full information on this interesting development write the Jervis B. Webb Co., 8933 Alpine Ave., Detroit 4, Mich. **T-5-833**

Glenzer LIVE CENTERS

THEY'RE SHOCK-PROOF

These Precision-Built Live Centers are especially designed to absorb the shocks that are bound to occur in all machining operations, due to heat expansion. Three-layer resilient pads automatically absorb this expansion. This relieves any excess pressure on the Timken bearing, which seats on these pads.

REDUCE TOOL BREAKAGE!

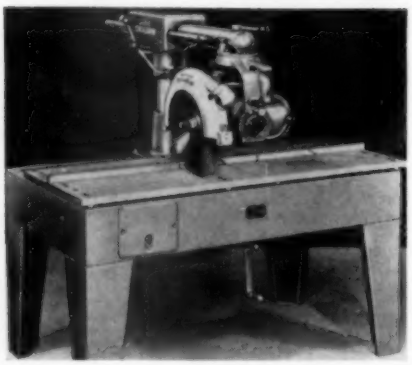
For longer tool life and frictionless drive, specify Glenzer Live Centers! They've been proven by the test of time.

THE J. C. GLENZER CO. Inc.

1552 E. NINE MILE ROAD, DETROIT 20, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-83

Radial Saw



Skilsaw, Inc., 5033 Elston Ave., Chicago 30, Ill., announces Model 450 radial saw which, as claimed by the manufacturer, is a "complete woodworking shop incorporated in one performance-proved unit." It is designed to rip, bevel, miter, dado, plough and rabbet with equal facility.

It is available with either manual or magnetic controls, with all adjustments within easy reach of the operator. It is further available in a variety of voltage, horsepower and motor cycle specifications and with either 14 or 16 in. blades. The space required is 4½ x 6 ft., and work table is 11¼ in. deep.

10" or 14"
TWIN
WET
OR
DRY
WHEEL
TOOL GRINDER
For Carbide, Stellite, or High Speed Steel Tools.
one step
from rough to finish grind
Heavy Duty
Wet or Dry
10" - 14" Wheels
PATENT PENDING
Type TD
10TD 10" - 14TD 14"
Twin Wheel
Tool Grinder
(Also SINGLE CUP WHEEL)
Also:
GRINDERS — ALL KINDS! UP TO 100 H.P.
BUFFERS — POLISHERS UP TO 60 H.P.
ABRASIVE BELT MACHINERY
SPECIAL MACHINERY
WALL
OLD WAY
Lost time between rough and finish grind.
Floor space wasted — Grinder must be away from wall.
NEW WAY
One step from rough to finish grind.
Conserve floor space — place Grinder against the wall.
Positively no spray or splash when grinding wet!
WRITE FOR BULLETIN 18 TODAY!
THE STANDARD ELECTRICAL TOOL CO.
Visit our Booth 103, Triple Industrial Supply Convention, San Francisco, June 11, 12, 13. We would like to discuss the type TD with you!
2499 RIVER ROAD
CINCINNATI 4, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-84

As a special feature, the bearings may be re-aligned to within 0.001 in., thereby insuring consistent accuracy for the life of the machine. **T-5-841**

"Quick Change" Collet

Sutton Tool Co., Sturgis, Mich., announces an improved master collet in which the pads can be changed without removing the collet from the machine spindle. Holding features of this Style "FL" quick change collet are the replaceable pads which are securely locked to prevent slippage from bar thrust, and a "diamond serrated" grip for holding both horizontal and rotating thrusts. Available for automatic screw machines, this tool handles all sizes and shapes of stock within capacity limits, and is suggested for larger machines where tooling costs are especially heavy. **T-5-841 A**

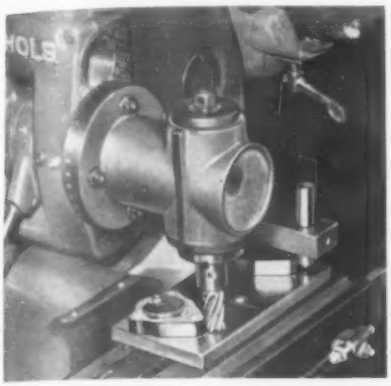
Safety Valve By Ross

Greater safety for operators is claimed for an air control solenoid valve introduced by Ross Operating Valve Co., 120 E. Golden Gate, Detroit 3, Mich. Known as the Ross "Safety Valve" and developed in cooperation with safety engineers, this valve is designed to move to a safe position even if the air or electrical supply should be interrupted. The valve features elimination of all springs; this, together with the use of a clapper-type solenoid, adds materially to operator protection.

Current consumption is said to be exceptionally low—0.56 amp. holding and 4.3 amp. inrush at 115/60. The valve ordinarily operates with line pressures of 40-125 psi, but can be designed to work outside of these limits. It is available in ¼ to 1¼ in. pipe sizes, straightway or 3-way, normally closed or normally open, and can be in-line or bracket mounted. Complete details on this interesting development may be had from the manufacturer. **T-5-842**

Milling Attachment

W. H. Nichols Co., Waltham, Mass., announces a precision vertical milling attachment which quickly converts standard horizontal Nichols Millers for diversified vertical milling operations. The unit is designed to take full 1 HP drive with speeds up to 2000 rpm.

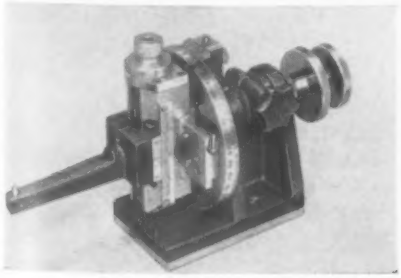


The spindle of the attachment, which is built to Nichols precise standards, is mounted in zero hearing and held within 0.00015 in. indicator reading. The spindle nose, bored No. 40 Natl. Standard taper, is identical with the nose of the horizontal spindle nose and interchanges all tooling. A drawbolt is furnished and draw-in collet attachment is available as extra equipment. Full information may be had from Nichols-Morris Corp., National Distributors, 50 Church St., New York 7, N. Y. **T-5-851**

Tangi-Matic Dresser

A tool for precision dressing of all angle-tangent-to-radius grinding wheel forms—the Tangi-Matic—is designed to eliminate gage blocks or other measuring instruments. According to the manufacturer, it further effects a marked reduction in setup time.

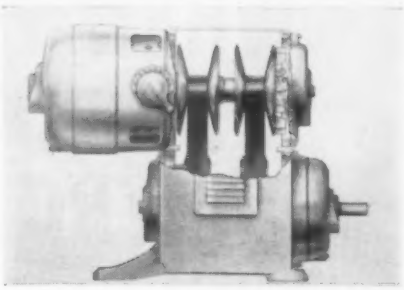
As constructed, a built-in micrometer provides direct reading, rapid adjustment and claimed accuracy to 0.0001 in. Setting for angles is by vernier scale, graduated in minutes, and two stop dogs control desired arc. By use of a small radius attachment, furnished, concave radii as small as 0.032 in. in full 180 deg may be dressed as stated by the maker, Perfex Tool & Gage Co., Dept. BF, 123 Avery St., Mt. Clemens, Mich. **T-5-852**



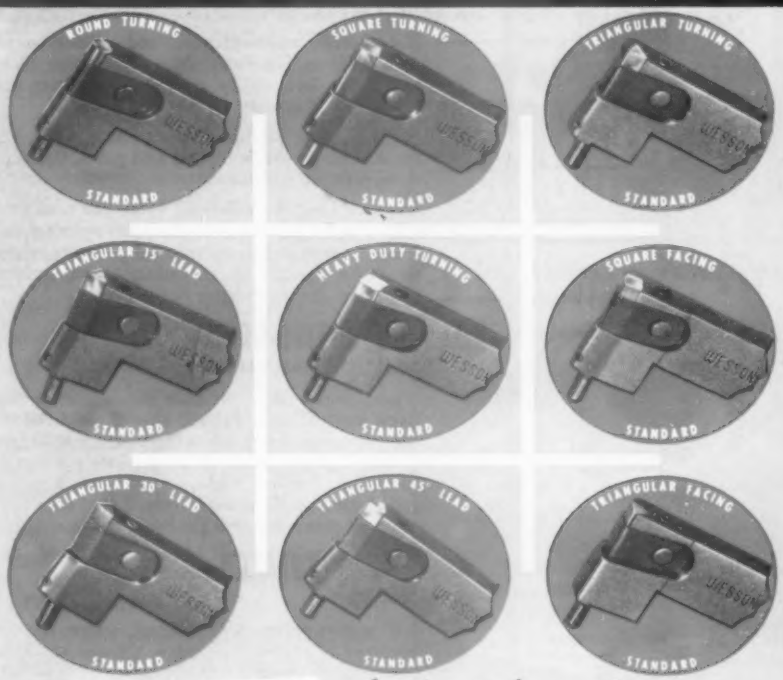
Variable Speed Motor

A line of extra heavy-duty motors, for variable speed, incorporate dual varibelts to carry the heavy load through the internal speed changing transmission.

The principle employed avoids the disadvantages of variable center drives or extra flexing of belts over idlers. A calibrated spring, used to maintain pressure between two halves of the driven varidiscs and the sides of the belt, takes up any slack caused by stretch or wear of the belts. Speed change is accomplished by turning a control dial. Full information may be had from U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54, Calif., or Milford, Conn. **T-5-853**



WESSON'S NEW BAND TYPE MULTICUT HOLDER 9 ★ 90° STANDARD TYPES STANDARD SIZES



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WHEN YOU NEED DEPENDABLE CONTROL VALVES

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Whether you need solenoid valves to control air-operated fixtures or whether you must control the flow of gas, liquids or refrigerants in processing parts, it will pay you to investigate A-P control valves.

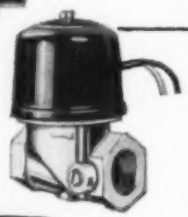
A-P offers a wide variety of valves adaptable to temperature, pressure or electric control. Years of experience, unexcelled engineering and production facilities, close quality control and meticulous testing guarantee unusual dependability of operation and performance.

REMOTE CONTROL
SOLENOID VALVES

Heavy-duty, pilot-operated, industrial-type solenoid valves for water. Non-overheating moisture-proof coil, easily removable strainer and valve seat. Capacity to 3000 gal. per hr.

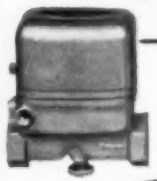
Multi-purpose solenoid valve. Handles air, water, or non-corrosive liquids and gases. Capacity up to 600 gal. per hr.

Rugged, long-life solenoid valve for low pressure air or gas control. Positive opening and seal-off, even with voltage or pressure variations. No sticking or gumming. Quiet, no-hum operation due to unique design.



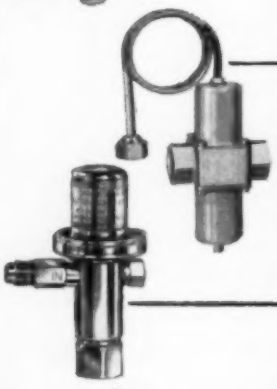
SILENT, POSITIVE-OPERATION
THERMO-ELECTRIC GAS VALVES

Where inexpensive, reliable automatic temperature control is required, this thermo-electric gas valve has many advantages. Its diaphragm-operated power element is absolutely silent in operation. Positive, tight seal-off; full opening, full closing on 30-second cycle. Large capacity; compact size; dependable functioning.



PRESSURE-REGULATED
WATER VALVES

A-P water valves will control water flow in response to pressure changes. Unique valve design permits trouble-free operation even in very dirty water. Operating pressure adjustable from 65 to 300 p.s.i. Maximum water pressure 150 p.s.i. 3/8″, 1/2″, and 3/4″ sizes; capacities from 3 to 42 gal. per min.



PRESSURE OR TEMPERATURE CONTROLLED
EXPANSION OR THROTTLING VALVES

Designed primarily for refrigerant control, A-P expansion valves are adaptable to many applications where automatic control of temperatures or pressures is required. If you have a problem involving the control of liquid or gas flow in response to pressure or temperature changes, a standard, low-cost A-P expansion valve may provide an immediate answer.

DEPENDABLE Controls

For Air • Liquids • Gases • Refrigerants

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(formerly Automatic Products Company)

2402 N. 32nd St., Milwaukee 45, Wis. • In Canada: A-P Controls Corporation Ltd., Cooksville, Ont.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-86

Technical Shorts . . .

Development of a tungsten known as Hi-Thoria, has been announced by the General Electric Company's Welding Division. Major applications, it is said, will be for inert-arc welding with direct current, straight polarity using either argon or helium gas.

Among a number of advantages claimed for this development, is that electrodes of the material produce a stable arc of a wider range of current and will resist contamination by weld metal resulting in over ten times normal life. At the same time, according to the engineers, Hi-Thoria has strength comparable to standard pure tungsten. Further, it runs cooler than standard tungsten, and does not become molten, thus the end of the electrode remains intact; consumption tends to be reduced since no molten surfaces sputter off into the work and in addition, it is seldom necessary to stop welding in order to clean or break off the end of the electrode.

The alloy is not recommended as a standard tungsten replacement for reverse polarity d-c, a-c welding, or atomic hydrogen welding.

A number of intensive training courses of special interest to those in the trade have been scheduled for this summer by technical schools throughout the country.

Corrosion will be the subject of a one-week course beginning June 18 at the Massachusetts Institute of Technology, where leading industrial authorities will join members of the faculty to present the material, aiming principally at bringing new information about corrosion control to men in industry.

Designed to meet needs of research directors and plant engineers who wish to review recent trends and developments, the course will cover characteristics and mechanisms of corrosion and corrosion control, design of equipment, chemical treatment of the environment, cathodic protection and selection of coatings and alloys economically feasible for reducing corrosion losses.

Also at M.I.T., three phases of mechanical engineering will be offered in courses particularly designed to bring latest information derived from research and industrial practice to engineers in industry unable to participate in regular academic activities.

The three special fields to be covered include lubrication engineering.

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INDICATE A-5-87-1

June 11-22; metal cutting, June 25-July 6, and hydraulic power control, July 9-20.

The courses will review basic and special information in addition to stressing recent developments and their practical applications.

At the same school, a ten-day series of lectures on recent progress in the metallurgy of steelmaking will include material on research, plant developments to improve use of raw material, increase steel quality and speed production. In addition to members of the faculty, authorities from the steel industry and from other educational institutions will take part. The course according to its directors will be open to technically trained persons having an interest in the problems of iron and steel making, and preferably having basic knowledge of chemistry.

Information on any of the above courses concerning tuition, reservations and accommodations may be obtained from Prof. Walter Gale, Director of M.I.T. Summer Session, Room 3-107, Massachusetts Institute of Technology, Cambridge 39, Mass.

The College of Engineering, State University of Iowa, announces its twelfth summer management course covering production planning, job evaluation, motion and time study, wage incentives, plant layout, quality control, supervisory training, and other pertinent subjects. It will be held June 11-23.

Described as an intensive course for factory managers, foremen, industrial engineers, methods and time study analysts and office executives, it will be conducted by the regular university teaching staff augmented by men outstanding in their fields.

Inquiries concerning the sessions should be directed to J. Wayne Deegan, 122 Engineering Building, State University of Iowa, Iowa City.

"Statistical Quality Control" will be the subject of the training course at the University of Colorado from June 19-29. Sessions, which are slated to include acceptance sampling and other industrial statistical methods used in industry, will be conducted by men who have had experience both in the teaching of this technique and in its application in industry and business.

Applications and further information can be obtained from John F. Wagner, College of Engineering, University of Colorado, Boulder.

The next private seminar on the organization and operation of company standardization work will be held by Dr. John Gaillard in the Engineering Societies Building, New York City, June 8-22. Details and registration may be handled through Dr. Gaillard, 400 West 118 St., New York 27.

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WRITE FOR CATALOG

INDICATE A-5-87-2

Tool Saving Tips

TO HELP YOU GET MORE WORK FROM FEWER CARBIDE TOOLS

Today's production may bring you new problems, including:

- *An entirely different type of work requiring appropriate carbide tooling techniques.*
- *Converting some or all of your facilities to carbide tooling.*
- *Training new personnel in the use and maintenance of carbide tooling.*
- *Or, you may have been using carbide tooling for years, but are now faced with short tool supplies, increasing production schedules, and limited skilled personnel.*

In any of these situations your nearest Kennametal field engineer can help you reduce guesswork and experimenting, save wasted time and materials, and gain greater productivity.

Every day Kennametal field engineers encounter, and help solve, scores of carbide machining jobs. They know their Kennametal from the ground floor up — know the performance of various compositions and tool designs for cutting different metals, on practically every type of operation.

Your Kennametal representative is ready to bring you this collective experience — the greatest accumulation of "know-how" that is available through any one source. Ask him for suggestions that will ease the strain on materials, machines, and men in your shop. Call our nearest field office — see list below.

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SPOKANE TERRITORY —Box 4062 Station B
SPRINGFIELD —1537 Main Street
ST. LOUIS —4505 Olive Street
SYRACUSE —414 Wendell Terrace
TULSA —Daniel Building

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-88

Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

CASTING AND FORMING PROCESSES IN MANUFACTURING, by James S. Campbell, Jr. 536 pp., illustrated. Published by the McGraw-Hill Book Co., New York, N. Y., price $3.50.

In the publication of this book, Rensselaer Polytechnic Institute completes its two-volumne text basis for the study of manufacturing processes. The companion study by Charles H. Hine, who like Campbell is a member of the Rensselaer engineering staff, appeared previously under the title "Machine Tools for Engineers."

The current volume is slanted directly to the needs of young engineers who, entering industry on graduation, want to know more about the practical aspects of manufacturing. Those going into machine design are particularly in need of precise knowledge of modern manufacturing processes, and in this regard the book includes the know-how necessary to that purpose.

A BIBLIOGRAPHY OF STATISTICAL QUALITY CONTROL, by Grant L. Butterbaugh. Published by the University of Washington Press, Seattle, Wash. 141 pp.; price $2.00.

This bibliography, which is a supplement to the 1946 edition, covers the period from 1946 through June 1949 and lists approximately 725 items. The listing includes articles published in the various trade papers and technical magazines, including The Tool Engineer.

MACHINING—THEORY AND PRACTICE, published by the American Society for Metals, Cleveland, Ohio. 504 pp.; illustrated; price $6.50.

A series of thirteen educational lectures on machining-theory and practice presented to members of the A.S.M. at the 31st National Metal Congress and Exposition, Cleveland, Ohio, the papers include:

Metal Cutting: Art to Science, Hans Ernest; Metal Cutting Research—theory and application, M. E. Merchant; Cutting Fluid Theory, M. C. Shaw; Materials and Machinability, F. W. Boulger; Development of the Macrostructure of Metals by Machining, L. M. Clarebrough and G. J. Ogilvie.

Metallurgy and Machinability of Steels, J. D. Armour; Tool Steels, G. A. Roberts; Cemented Carbide Tool Materials, J. C. Redmond; Heat in Metal Cutting, A. O. Schmidt; Evaluation of Machinability of Rolled Steels, Forgings and Castings, Michael Field and

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INDICATE A-5-89-1

N. Zlatin; Tool Life Testing, O. W. Boston; Some Metallurgical Aspects of Grinding, L. P. Tarasov; and Economics of Machining, W. W. Gilbert.

As implied by the title, the book deals with theory and practice on various phases of metal cutting which, at first thought, might be of interest mainly to research men and metallurgists. Even if so limited, the work is more than warranted by the exchange of knowledge; actually, however, it is a symposium by leading authorities, several of whom are prominent ASTE members, and as such of more than ordinary interest to the rank and file of tool engineers.

DIE CASTING, by H. H. Doehler, Chairman of the Board, Doehler Jarvis Corporation. Published by McGraw-Hill Book Co., New York, N. Y. 502 pp., illustrated; price $8.00.

Written by a pioneer in the field, the book is an authoritative coverage of practically every phase of die casting. It gives metallurgists, equipment and product designers, and tool engineers, the production data and general know-how needed for the most advantageous design and use of die casting equipment.

Tracing historical development, the book describes components and operations of various types of die casting equipment together with an unusually complete discussion of die design and constructions from single cavity units to large dies used for casting an entire automobile door.

Included are chapters on machining and finishing, with recommendations on use of tools; fixtures for punching and trimming; estimations of die casting costs and safety in die casting plants. A glossary embraces terms that are widely used in the die casting process.

STEEL CASTING HANDBOOK, published by Steel Founders' Society of America 1950 edition, 522 pp; price $4.50.

This reference volume on steel casting has been completely revised since the previous printing in 1945, and now includes 440 illustrations and some 120 tables in addition to covering about every facet of the steel casting industry.

Sources of material are practically coextensive with the entire industry and includes literature on the subjects covered as well as previously unpublished information now made available by authorities both in and out of the industry.

Few if any items related to steel casting are omitted, and the book is not only of value to designers, engineers, metallurgists and founders, but to purchasing personnel as well. Copies may be had by writing to F. Kermit Donaldson, Executive Vice President, 920 Midland Bldg., Cleveland 15, Ohio.

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A. S. T. E. NEWS

Continued from page 71

George Tillotson, scholarship chairman, presents Dayton chapter's student award to Kenneth Flavin, Sinclair College senior. Looking on at left and right are: C. R. Miller, retiring chapter chairman, and C. C. Bussey, director of Sinclair College.

Casting by the Osbrink Process" were pointed out by R. E. Saunders of Saunders Castings, Inc., Wichita. Demonstrating with samples used as cast, Mr. Saunders explained how large and small parts could be cast to tolerances of less than 0.010 in. A surface finish of better than 100 rms can be maintained on such castings, the speaker added. Approximately 60 members and visitors heard the lecture.

Harold Elwood of the Cessna Airplane Co. gave the coffee talk and rendered several novelty selections on the piano.

LONG BEACH, CALIF.—In a closely contested election, Long Beach chapter chose new officers at a dinner meeting in Chu-Chu's Restaurant, Compton, February 14. Fifty-nine members turned out for the balloting.

Heading the year-old chapter for 1951-52 are: William B. MacKay, chairman; Frank D. Wallace, first vice-chairman; Edward A. Smith, second vice-chairman; Carroll B. Edson, secretary; John A. Morgan, treasurer; Arthur Thomas, delegate, and J. H. Stansbury, alternate.

During the evening a group of members presented a birthday cake to K. M. Nelson.

Largely through the efforts of its charter officers, the 84th chapter is now 50th in membership rank.

DOVER, N.H.—Granite State chapter named Charles Nystedt to head its affairs for its first full year of existence, at an election meeting in the American House, February 13. Elected to serve with Mr. Nystedt are: Harold Perkins, first vice-chairman; John MacInnes, second vice-chairman; Joseph Rousseau, secretary, and Richard Wiley, treasurer.

"Quality Control," the technical topic, was presented by M. Douglas Benedict of Gillette Safety Razor Co., Boston, Mass. In this age of precision, Mr. Benedict said, it is necessary to have answers to problems before they occur.

Anticipate Machine Capability

Often, he added, a plant can benefit through interpreting a customer's wants by a thorough knowledge of specifications already outlined by quality controllers. Through this critical study, overall improvements in quality can be achieved, since the predetermined safety factor of a machine can be applied to tolerances of the anticipated product.

Of the basic factors which Mr. Benedict cited as entering into the manufacture of a product, machine capability was listed as the cheapest to evaluate.

DAYTON, OHIO—A $100 scholarship was awarded to Kenneth Flavin, a Sinclair College senior, by Dayton chapter at a meeting held February 12 in Suttmiller's Restaurant. The presentation was made by George Tillotson, scholarship chairman.

Mr. Tillotson, sales engineer for Delco Products Div., General Motors Corp., also presented the technical feature, a film depicting a local industry, the making of Delco electric motors.

After dinner speaker was Russell McClure, city manager, who explained the commission management plan and problems of municipal government.

During a business session the follow-

ing officers were elected: L. R. McAfee, chairman; R. M. Blair, first vice-chairman; R. A. Miller, second vice-chairman; William Lawrence, secretary; John Kitts, treasurer; C. R. Miller, delegate, and Gordon Letsche, alternate.

Guests included C. C. Bussey, director of Sinclair College, who participated in the scholarship presentation.

CHICAGO, ILL.—A practical application of atomic energy for power production is not far off, in the opinion of Dr. Harvard L. Hull, director of the Argonne National Laboratory, Division of Remote Control Engineering.

While addressing Chicago chapter's election night meeting, February 13, Dr. Hull indicated that he expected his belief to be demonstrated reasonably soon in the development of an atomic powered submarine.

Tool Controls Pose Problems

Much of his discussion centered around ingenious mechanisms devised to permit laboratory personnel to handle radioactive products with safety. Since the operator must stay outside a thick concrete wall, designing remote control mechanisms to operate machine tools is extremely complicated.

In the annual election conducted before the technical session, H. Dale Long was chosen chairman. Other members winning office are: H. V. Loeppert, first vice-chairman; Harry A. Paine, second vice-chairman; John H. Beck, third vice-chairman; Gordon J. Benes, secretary; John J. Kayda, treasurer; Tom C. Barber, delegate, and Mr. Long, alternate.

Approximately 180 members and guests attended the meeting at the Western Society of Engineers headquarters.

CEDAR RAPIDS, IOWA—A new slate of officers was voted in by Cedar Rapids chapter at a dinner meeting, February 21, in the Montrose Hotel. The successful candidates are: Wencil D. Popek, chairman; Edwin F. Klouda, first vice-chairman; Richard Coyner, second vice-chairman; Carroll Bryant, secretary, and K. E. Ferguson, treasurer.

Mr. Popek was also named delegate to the annual meeting.

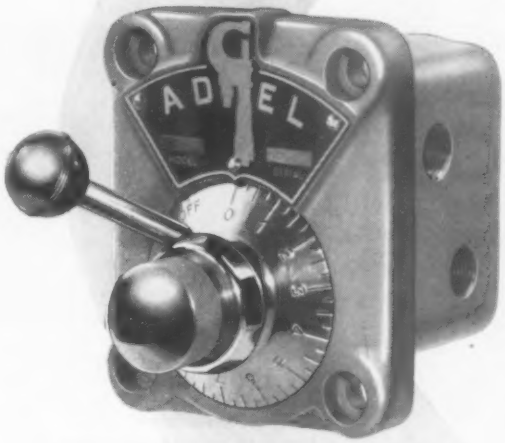
Friction Saw Cuts Rapidly

Principal speaker was James M. Lewis, a consulting engineer for Kling Brothers Engineering Works, Chicago, Ill. His discussion of "Modern Friction Sawing" was illustrated with slides showing applications of fast metal cutting by friction sawing.

Dr. F. C. Tucker, pathologist at St. Luke's Hospital, related his experiences in China and Korea while serving as a

THE NEW ADEL

FLOW CONTROL VALVE FOR VERSATILITY



Adjustable from completely shut off position to 25 G.P.M. maximum flow. Will maintain constant fluid flow and constant machine feed over a wide range of pressures and feed resistances.

The diagrams show but two of innumerable circuits and systems where this versatile and better valve can be used to advantage.

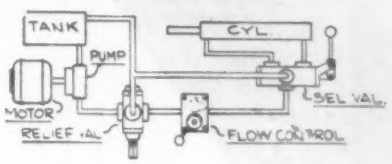


Diagram illustrates typical circuit showing control of cylinder.

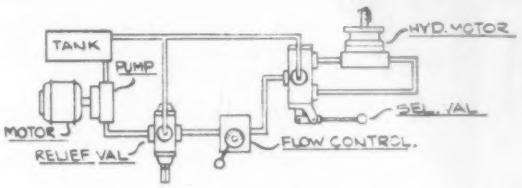


Diagram illustrates typical circuit showing control of hydraulic motor.

8 model variations are available—¾ in. Pipe Size—1, 2, 4 & 6 G.P.M. Flow Max.

¾ in. Pipe Size—10, 15, 20 & 25 G.P.M. Flow Max.

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1. Valve is compensated type which maintains substantially a constant flow regardless of variation in inlet and outlet pressure.
2. Maximum recommended inlet pressure 1500 P.S.I.
3. Maximum recommended outlet pressure equals inlet pressure minus 100 P.S.I.
4. No drain line required.
5. Wide range of control lever rotation (270°) permits extremely accurate flow settings.

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Top: Speakers' table guests at Houston's second industrial night are, from left: H. E. Collins, national director; E. F. Snow, comptroller, Reed Roller Bit Co.; C. H. Elliott, manager, Cleco Div., RRB; T. J. Gilchrist, chapter chairman; W. J. Vossbrinck, Cleco sales manager, and Oscar Selker, shop superintendent at Reed. Below: Hartford members inspect tooling of contour boring machines during visit to New Britain Machine Co.

medical liaison officer with the Chinese Nationalist Army.

HOUSTON, TEX.—Honoring the Cleco Div., Reed Roller Bit Co., Houston chapter held its second industrial night, February 13, at Ben Milam Hotel.

W. J. Vossbrinck, Cleco sales manager, discussed "Air Tool Application" and answered questions on the care and use of various types of air tools.

C. H. Elliott, general manager of the division, reviewed the company's history, emphasizing the importance of modern equipment, tooling and methods.

Schuller Elected to Top Office

New officers to head up the chapter for the coming year were elected during the meeting. They are: R. E. Schuller, chairman; G. L. Freeman, first vice-chairman; H. O. Traughber, second vice-chairman; H. W. Boswell, secretary, and J. W. Hindman, treasurer.

Dinner and a social hour preceded the business and technical sessions.

HARTFORD, CONN.—Some 200 or more Hartford ASTE'ers visited New Britain Machine Co. in a Members Night plant tour, February 5.

Company personnel escorted the engineers through the buildings in groups of about 25. At each of five points of particular interest an operator and an engineer were stationed to give the visitors full information on the operation and tooling.

The numerous questions asked at each stop were handled expertly by company guides. An efficient messenger system kept the tour progressing smoothly.

What the members saw they found impressive—tooling and production geared to true American ingenuity.

Toppin Is Chairman

When the final group had completed the tour there was a brief business meeting and election of chapter officers. The new executives are: Robert M. Toppin, chairman; Henry E. Kuryla, first vice-chairman; William T. Allison, second vice-chairman; Omer A. Gingras, treasurer; Edward T. Ross, secretary; D. B. Huntting, delegate, and Mr. Toppin, alternate.

Following dinner in the plant cafeteria, Bob Hewitt, cowboy explorer, lecturer and photographer, presented a travel lecture and film, "Roaming in Wyoming."

UTICA, N. Y.—Mohawk Valley chapter joined with the local chapter of ASM for a meeting at the Moose Home, February 13. One hundred and four members of the two societies attended.

Following dinner the ASTE group elected its officers for the 1951-52 term. The new slate includes: Arnold K. Schroeder, chairman; Albert C. Delmont, first vice-chairman; Earl K. Wheat, second vice-chairman; Paul K. Lyman, secretary, and Nicholas Kinney, treasurer.

Fred Barker, retiring chairman, presided and conducted the election.

Mr. Wheat introduced the technical speaker, Donald R. Luster of the Rem-Cru Titanium Co., Pittsburgh, Pa. In his talk, "Titanium and Its Alloys," Mr. Luster described this metal from ore extraction to what is currently known concerning its properties, alloys, corrosion resistance, and methods of fabrication. Reduction in its present high cost is expected with increasing applications, Mr. Luster told the group. Slides illustrated the lecture and pointed up advantages of this metal.

POUGHKEEPSIE, N. Y.—The potentialities of "Precision-Investment Casting" have not been fully utilized, according to George R. Barrow, field metallurgist with Haynes Stellite Div., Union Carbide and Carbon Corp.

Designed Parts for Process

Until recently, he told Mid-Hudson members at their February 13 dinner meeting, such castings have had application mainly for parts made of alloys not readily machinable, or for economy. Full realization of the importance of investment casting will come only when parts are designed especially for production by this process, he predicted.

Prior to Mr. Barrow's talk the atomic defense film, "Pattern for Survival," was shown through the cooperation of Lafayette Post of the American Legion.

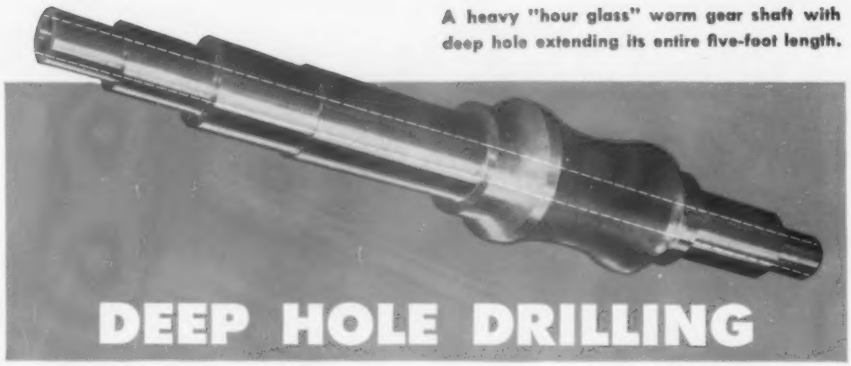
New officers were elected during a business session. Ellis W. Thorp, chairman, presided.

EVANSVILLE, IND.—Elmer J. Vanderploeg, assistant chief engineer of The Yoder Co., Cleveland, Ohio, addressed Evansville chapter at a dinner meeting in the Alpine House, February 12. Mr. Vanderploeg's subject, "Possibilities

Henry Appel (left), program chairman of Evansville chapter, introduces Technical Speaker Elmer J. Vanderploeg, assistant chief engineer, The Yoder Co., Cleveland, Ohio, and Elmer Koening, sales manager for Yoder.

and Limitations of Cold Roll Forming," was presented at the Society's 1950 annual meeting in Philadelphia.

In the balloting for new officers



A heavy "hour glass" worm gear shaft with deep hole extending its entire five-foot length.

A Complete Engineering and Manufacturing Service

The drilling and boring of deep holes, especially in the newly developed alloys (in many cases hardened before machining), is so vastly different from ordinary machine shop practice that few manufacturers realize the extent of the difficulties involved.

This is only natural, because many experienced all-around shop men have, in most cases, only recently been called upon to do work of this particular kind.

A thorough study of the subject, and the exclusive practice in deep-drilling and finish boring all manner of hard alloys have, over the years, given us a wealth of accumulated experience.

Therefore, when your schedule calls for deep hole production, it will pay you to employ us, and have us review your requirements in relation to your facilities. The engineering fee charged by us for preliminary work has, in the past, never failed to substantially reduce the over-all production cost.

Wherever warranted, we provide you with a formal method study evaluating all processing possibilities.

Through this we will not only arrive at the design of the tools best suited to drill and bore your deep holes economically and well, but also, and this is equally important, the correct procedure in making these tools work, including a detailed description of the machines and other facilities required, the exact power needs, and a realistic estimate of the time the operation will take.

In many cases, rather than have us furnish you with the tools for use in your plant, you will find it advantageous to have us do your deep hole drilling and boring for you in our own shop, under our own expert supervision.

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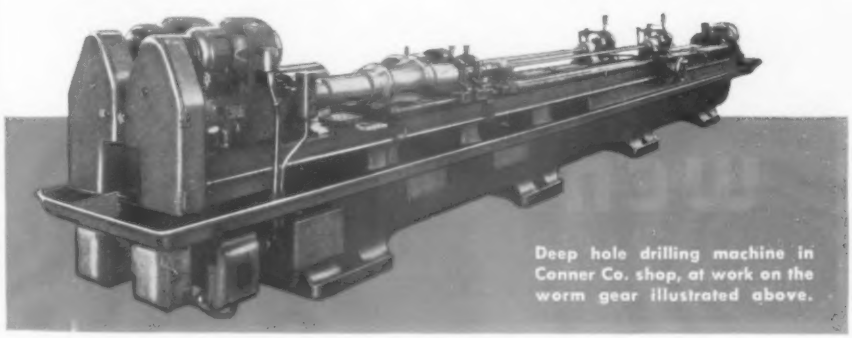

Deep hole drilling machine in Conner Co. shop, at work on the worm gear illustrated above.

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Charles H. Thuman won the chairmanship. Others elected are: Henry J. Pernicka, first vice-chairman; Paul W. Vierling, second vice-chairman; Bernard E. Pampe, secretary; Arthur R. Ullman, treasurer; Walter V. Stippler, delegate, and Howard C. McMillen, alternate.

During the coffee period Bish Thompson, drama and literary critic and radio columnist for the *Evansville Press*, entertained with a humorous talk.

Many of the 85 members and guests in the audience remained to play cards after the meeting adjourned.

Extra Technical Sessions Meet Special Interests

Hartford, Conn. — Sponsored by Hartford chapter's Technical Activities Committee, a special technical session was presented February 19. A. A. Heckmann of the Cincinnati Milling Machine Co. addressed the chapter on the controversial subject, "Milling vs. Broaching."

With the help of cost comparison charts on actual operations, plus a collection of excellent slides, Mr. Heckmann cleared up problems on how to determine which of the two machining methods to use.

From his wealth of experience in these fields, the speaker answered questions during a lively discussion period.

Surveyed Members

The Technical Activities Committee, headed by Omer A. Gingras, was organized to present programs to meet the varied technical interests of more than 500 tool engineers. Established by the Executive Committee under the guidance of Clayton S. Parsons and Donald B. Huntting, former chapter chairmen, the committee polled the membership to determine trends of interest.

Experts in the most demanded subjects were sought out, preferably from within the chapter. Lectures and panel discussions have been arranged as supplementary meetings each month.

Through this medium the chapter has not only satisfied most of the specialized interests of its membership, but it has also boosted itself among New England industries.

Obituary

Thomas A. Thompson

Thomas A. Thompson, 43, of the research and development department of U.S. Steel Corp. of Delaware, died March 14 at Pittsburgh, Pa. He had also been employed by Pullman Standard Car Mfg. Co., Hammond, Ind.,

American Bantam Car Co., Butler, Pa., and Bell Telephone Co., Pittsburgh, and Chattanooga, Tenn.

A member of Pittsburgh chapter, Mr. Thompson was a native of Butler where he had resided most of his life.

Girard Joins T.E. Staff Tull in Standards Post

Detroit, Mich. — Stanley F. Girard, former secretary to the ASTE National Standards Committee, has been appointed western advertising manager for *The Tool Engineer*, Allan R. Putnam, business manager, has announced. Mr. Girard will have his headquarters at 540 N. Michigan Ave., Chicago 11.

His territory includes Illinois, Wisconsin, Indiana, Minnesota, Missouri, Iowa, and the Dakotas. Associated with the national headquarters staff since December of 1945, Mr. Girard has been in contact with the machine tool trade through the processing of product data sheets distributed by the National Standards Committee.

R. L. Tull

S. F. Girard

Succeeding Mr. Girard in the Standards Committee secretaryship is Richard L. Tull of Detroit. During World War II Mr. Tull served with the Information and Education Division of the U.S. Army, in the European theater. Subsequently he was employed in sales capacities at Hollywood, Calif., and Chicago, Ill.

Coming Meetings

AKRON—May 11, 7:30 p. m. Plant tour, Cooper-Bessemer Co., Mount Vernon, Ohio.

(BRIDGEPORT, CONN.) FAIRFIELD—May 2, Stratfield Hotel, Bridgeport. Speaker: W. W. Goehring, machine tool engineer, S.K.F. Industries. Subject: "Anti-Friction Bearings and Their Uses in Machine Tools." June 6. Connecticut Night.

CEDAR RAPIDS—May 25, 6:00 p. m., Ox Yoke Inn, Amana. Tour of Amana Society Woolen Mills.

CHICAGO—May 8, 6:30 p. m.—Klas Restaurant, Cicero. Speaker: Dr. Francis W. Hibler, psychological consultant to management, Rohrer, Hibler & Replogle. Subject: "Psychology and

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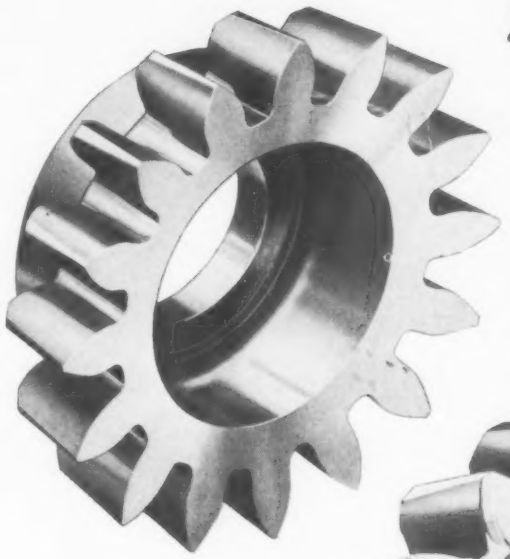

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Advancement for Tool Engineers," March 17-21, 1952. Tool Engineers Industrial Exposition.

DETROIT—May 10, 6:30 p. m., Engineering Society of Detroit. Panel Discussion: "Current Gear Production Problems." Speakers: Charles Staub, chief engineer, Michigan Tool Co., "Hobbing Practices"; George Sanborn, Fellows Gear Shaper Co., "Shaping Practices," and Benjamin Bregi, National Broach & Machine Co., "Gear Finishing Practices."

ERIE—May 1, 6:30 p. m., Lafayette Hotel, Meadville. Speaker: Carl E. Blass, manager of planning, Talon, Inc. Subject: "Material Handling." Tour of Talon plant follows.

(FLINT) SAGINAW-VALLEY—June 16. Outing.

MONTREAL—May 10, Canadian Legion Memorial Bldg. Speaker: W. T. Nystrom, Brown & Sharpe Mfg. Co., Providence, R.I. Subject: "Modern Inspection and Gaging Methods."

(NEWARK) NORTHERN NEW JERSEY—May 8. Speaker: H. J. Greif, regional manager, Eutectic Welding Alloys Corp. Subject: "New Welding Methods and Rods for Salvaging Tools and Dies."

PHILADELPHIA—May 17, Engineers Club. Speakers: W. Van Ormer and Boyd H. Work, The Carborundum Co. Subject: Grinding Symposium. June 2. Outing.

RACINE—June 8, 12:00 noon. Brown's Lake Golf Course and Liggets' Royal Palm Garden. Annual Frolic.

(SPRINGFIELD, VT.) TWIN STATES—May 9, Springfield. Speaker: O. E. Olivieri, J. K. Smit & Sons, Inc. Subject: "New Applications of Industrial Diamonds and Powdered Metals."

(WASHINGTON, D. C.) POTOMAC—May 10, Dodge Hotel. Speaker: Dr. H. B. Osborn, Jr., technical director, Tocco Div., Ohio Crankshaft Co., Cleveland, Ohio. Subject: "Induction Heating."

WORCESTER—May 8. Plant tour, A. G. Spaulding Co., Chicopee, Mass. June 5, Svea Gille. Smorgasbord. Subject: "Controlled Air Power," presented by the Bellows Co.

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-5-157	ADAMS CARBIDE CORP.		Illustrated booklet "Aids to Carbide Users", detailing the best method of brazing carbide tool tips and wear resistant parts.
A-5-20	ALLEGHENY LUDLUM STEEL CORP.	Catalog C-2	Shows complete line of CARMET standard cutting tool blanks and cutting tools, with specifications.
A-5-116	AMERICAN BROACH & MACHINE CO.	Catalog 450	Thirty-two page catalog of useful, practical broaching information.
A-5-75	ARMSTRONG-BLUM MFG. CO.	Bulletin ST-650	Bulletin describing MARVEL High Speed-Edge Hole Saws.
A-5-149	THE BELLOWS CO.	Bulletin CL-30	Thirty-page booklet describing Air Motors and Bellows ELECTROAIRE VALVE for full electrical control.
A-5-129	CHARLES H. BESLY & CO.		Tapping Manual describing latest data on tap selection and applications and best tapping procedure.
A-5-144-1	THE CLEVELAND TAPPING MACHINE CO.	Guide No. T-4	Production tapping guide on Cleveland Tapping Machines.
A-5-8	THE CINCINNATI SHAPER CO.	Catalog N-5	Describes company's line of powerful, accurate and versatile Shapers.
A-5-164	DELTA POWER TOOL DIV., ROCKWELL MFG. CO.		"The Power Tool Journal", bi-monthly publication of job data, time and money-saving ideas.
A-5-101	ENGIS EQUIPMENT CO.	Catalog No. T-551	Comprehensive catalog covering company's line of measuring equipment.
A-5-138	GORHAM TOOL CO.		120 page Tool catalog of useful information and engineering data.
A-5-117	ILLINOIS TOOL WORKS		Bulletin on the latest official standards information from A. S. A. Standard-B5.15-1950.
A-5-122	KELLER TOOL CO.		"The Hole Story of the Keller Airfeedrill", descriptive booklet on company's line of pneumatic tools.
A-5-130	METAL CARBIDES CORP.	Catalog CR-50	Describes company's line of tungsten carbide rolls.
A-5-121	MILLER MOTOR CO.	Bulletins A-105-H-104	Illustrated bulletins describing line of air, low and high pressure hydraulic cylinders.
A-5-155-3	NEW HERMES, INC.	H-41 and IM-41	Literature describes company's heavy duty engravogro and portable engravograph.
A-5-125-2	OAKITE PRODUCTS, INC.		"Some good things to know about Metal Cleaning", describes company's industrial cleaning methods and service.
A-5-114-2	PYOTT FOUNDRY & MACHINE CO.		Folder giving information on special size castings.
A-5-81	PYROXYLIN PRODUCTS, INC.		Pamphlet on ProxPeel-molten and solvent type protective and preservative packaging.
A-5-139	SCULLY-JONES & CO.	Bulletin No. 2-50	Shows complete line of S-J Arbors, Collars and Adapters.
A-5-13	SUNDSTRAND MACHINE TOOL CO.	Bulletin 607	Describe complete new line of Sundstrand Automatic Lathes.
A-5-104	THE HENRY G. THOMPSON & SON CO.		Metal cutting manual of shop tested, technical information on hack and band saw operations.
A-5-112-2	THE VAN KEUREN CO.	Catalog and Handbook No. 34	208-page volume covering 2 year research on thread measuring wires.
A-5-112-1	WAUKESHA TOOL CO.		Illustrated, descriptive Reamer catalog on company's line of quality cutting tools.
A-5-85	WESSON CO.	Bulletin No. 511	Bulletin on Wesson's new Ban Type Multicut Holders.
A-5-94	WENDT SONIS CO.		Reaming instruction chart determines feeds and speeds for cutting steel, ferrous, non-ferrous and non-metallic materials.
A-5-142	THE YODER CO.		68 page booklet on the mechanics and economics of tube-making.

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Bending
Manual, "It's Easy to Bend" deals with elements of bending in general as well as covering centered and off-center eye, circle, zero radius, scroll, square, spring or coil, tube, channel and many other bending problems, each clarified by text and drawings; also shows company's tools and accessories with descriptions, specifications and costs. **O'Neil-Irwin Mfg. Co.**, Lake City, Minn. **L-5-1**

Worm Gear Drives
Brochure treats company's worm gear drives emphasizing cost-saving points; touches on some history of activity of units in the line. **The Cleveland Worm & Gear Co.**, 3249-59 E. 80th St., Cleveland 4. **L-5-2**

Emulsifier
Technical bulletin No. 25 describes automatic emulsifier for liquid rosin size, giving general engineering data, details on how the unit operates and flow diagrams. **American Cyanamid Co.**, 30 Rockefeller Plaza, New York 20. **L-5-3**

Collet Chucks
Bulletin 8, on speed collet chucks for tool room and engine lathes and grinders, contains engineering specifications with full illustrations of each type chuck for threaded nose, cam lock, taper key drive and American Standard spindles, with special features of line shown clearly; also includes specifications and price tables. **Hardinge Brothers, Inc.**, Elmira, N. Y. **L-5-4**

Valves, Hand and Foot
Technical bulletin, No. 303, describes company's ¼ and ⅜ in. 880 series hand and foot valves; covers installation data, engineering drawings, explanations of interchangeability of parts and ease of modification. **Ross Operating Valve Co.**, 120 East Golden Gate Ave., Detroit 3. **L-5-5**

Grinders
Circular shows number of jobs which were ground on Mattison grinders during last war; shows methods of grinding various types of work now again being considered. **Mattison Machine Works**, Rockford, Ill. **L-5-8**

Stud Drivers
Bulletin No. 236-R covers uses and operation of hand and power models "Aero-Thread" stud drivers; photos and drawings illustrate driving and removing studs of standard or special thread-form; detailed instructions with diagrams explain how to regulate stud driver, how to drive and extract studs and how to remove them from the driver; specification chart as well as sectional diagram of working mechanism also included. **Heli-Coil Corp.**, 47-23 35th St., Long Island City, N. Y. **L-5-6**

Milling Attachment
Improved design of universal spiral milling attachment presented together with complete description and specifications in catalog M-1718; includes helpful information on setting up attachment. **The Cincinnati Milling Machine Co.**, Cincinnati 9. **L-5-7**

Castings
Tabular summary of engineering properties of various types of Meehanite castings available to industry provided in 4-page bulletin 32; also contains data of use to casting designers charting information concerning property changes as affected by variations in section sizes. **Meehanite Metal Corp.**, New Rochelle, N. Y. **L-5-9**

Punching
Illustrated brochure M introduces multiple hole punching system designed to speed up production from drawing board to completed part; stressing speed, simplicity and economy. **Wales-Strippit Corp.**, 345 Payne Ave., North Tonawanda, N. Y. **L-5-10**

Steel, Stainless
Slide chart presents technical data and information on workability; includes standard analysis table of stainless steels with corresponding AISI type numbers as well as numerous other data and specifications on fabricating, machinability and other phases. **The Carpenter Steel Co.**, Reading, Pa. **L-5-11**

Contour Projector
Widely illustrated with photos and drawings, brochure discusses contour projector, what it is, and how it can be used to magnify dimensions, shapes and surfaces in production or tool making, describes some of the special jobs that can be done with the equipment, as well as presenting data on specifications, optics and accessories in considerable detail. **Industrial Optical Sales Div., Eastman Kodak Co.**, Rochester 4, N. Y. **L-5-12**

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Tools of Today—
Continued from page 83

Swiss Automatic

A single-purpose Swiss automatic screw machine, developed by Tornos Works Ltd., is announced by Carl Hirschmann Co., 30 Park Ave., Manhasset, N.Y., U.S. representative for the Swiss firm.

Identified as the Tornos Automatic Type TV, the machine is sold as a complete unit. Like other Tornos models, the TV embodies a sliding headstock, while a combination of four radial tools for turning, forming or cutting-off, a sensitive threading spindle and a slotting attachment of novel design enables fast production of high precision screws such as used in watches and instruments. A safety device stops the machine instantly should anything disturb the threading or slotting operations. **T-4-20**

Hydraulic Filter

The "Staynew" hydraulic filter, by Dollinger Corp., 11 Centre Pk., Rochester 3, N.Y., is designed for use wherever dirty liquids are collected and recirculated. It is suited for use in connection with all types of machine tools, and hydraulically operated machines and appliances.

There are only three major parts: the lower end plate, the insert and combined supporting tube, and the upper end plate. The insert is quickly renewable, or may be cleaned with solvent or brush. The filtering medium, of 100 mesh wire, may be had in various metals to suit different fluids.

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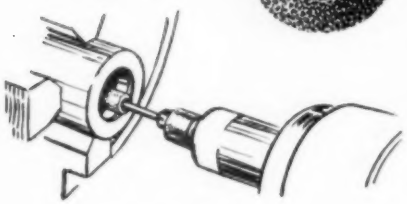

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North East West South IN INDUSTRY

Hanna Engineering Works is celebrating its fiftieth anniversary this year. The company was founded in 1901 by Elmer Ellsworth Hanna and incorporated two years later. Principal products during the early years were hydraulic yoke riveters and foundry sand sifters, expanded over the half century to its present wide variety of cylinders, valves and riveters.

Appointment of **John Obrebski** as metallurgist of **The Monarch Machine Tool Co.,** has been announced. Mr. Obrebski's previous experience includes an assistant professorship at Warsaw University, Poland, head of the research laboratories and heat treatment work at the Metallurgical Works in that country, as well as work at Alliance College in the United States.

Hayward A. Gay

John Obrebski

Three appointments, recently announced from **The Cincinnati Milling Machine Co.,** included **Hayward A. Gay** as vice-president of the company, **Carl M. Beach,** as domestic sales manager, and **Carl F. Stugard** as manager of the firm's Chicago office. Mr. Gay, who went to Cincinnati Milling in 1932 has served as a field engineer, manager of the Cimcool Div., and later of the Cincinnati Milling products division as well as vice president and director of the Mill's chemical subsidiary, Carlisle Chemical Works, Inc.

Mr. Beach, who has been with the Mill since his "co-op" days as a student, has been a field engineer, manager of the Detroit office and assistant sales manager. Mr. Stugard, who joined Cincinnati in 1937 was connected with the engineering service department, and later served as field engineer in New York as well as manager of the Pittsburgh office.

The Reed Rolled Thread Die Company of Worcester, Mass., has started construction on a new plant which will provide improved plant layout and added equipment.

Recently announced from the **Warner Division, Clinton Machine Co.,** were the appointments of **V. R. Peiffer** as director of production, and of **Carl L. Kalitta** as chief design engineer.

Before joining Warner, Mr. Peiffer was assistant plant manager at Bowen Products Corp., while Mr. Kalitta comes to the organization after 10 years' experience at Vickers, Inc., where he served in various capacities, specializing in aircraft hydraulics.

The **National Society of Professional Engineers** recently elected officers who will assume their offices July 1 for the coming year. **L. L. Dresser,** oil engineer and present vice-president of the Southwestern Area, NSPE, was named president of the organization. Area vice-presidents elected at the same time, included **George J. Nicastro,** Combustion Engineering-Superheater, Inc., Northeastern; **John F. Reynolds,** of Reynolds, Smith and Hills, Southeastern; **Colonel Chester Lichtenberg,** Central; **C. G. Roush,** Kansas City manager of Westinghouse, North central; **T. C. Forrest, Jr.,** Forrest and Cotton, Southwestern; **DeWitt C. Griffin,** Western. **Russell B. Allen** was elected to serve a fourth term as treasurer.

National medal awards for outstanding leadership in the steel casting industry were recently announced by F. Kermit Donaldson, executive vice-president of **Steel Founders' Society of America.** The society's top award, the Lorenz Memorial Gold Medal, went to **Thomas H. Shartle,** president of Texas Electric Steel Casting Co., and president of the society for the past two years. The Technical and Operating Medal was presented to **Paul H. Stuff,** chief metallurgist, Ross-Meehan Foundries; and **G. A. Lillieqvist,** research director and chief metallurgist, American Steel Foundries, received the annual Steel Foundry Facts award for excellence of material published in the society's technical publication.

Stanley E. Bovim has been appointed manager of the recently established branch office of **Allis-Chalmers'** general machinery division in Peoria, Ill. Mr. Bovim, who is a registered professional engineer in that state, has been associated with Allis-Chalmers since 1923.

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George M. Hollman has been named manager of the Defense Production Division for the **Alloy Rods Company.** Mr. Hollman, who has been associated with the welding industry for the past 14 years, formerly was midwest regional sales manager for the company.

William F. MacDonald has been elected president of **E. F. Houghton & Co. of Canada Limited,** Toronto. Mr. MacDonald succeeds the late G. W. Pressell.

The **L. S. Starrett Co.** has announced the retirement of **James G. Sisson** after 56 years of service. Mr. Sisson, who served as experimental engineer in the Starrett Dial Gage Division, has been active and well known for his work in standardization of the American Gage Design Committee.

At the same time the retirement of **E. E. Warner,** purchasing agent for Starrett since 1929, was announced. Mr. Warner is being succeeded by **C. B. McMillan,** previously assistant purchasing agent.

Mark W. Cresap, Jr., has been named a vice president and assistant to **Westinghouse's** president, Gwilym A. Price. Mr. Cresap is a co-founder of the management consultant firm of Cresap, McCormick and Paget.

Construction of a new parts plant is now under way at Des Plaines, Ill., according to a late announcement from the **Hannifin Corp.** This is the first of a series of buildings planned for this location by the company.

OBITUARY

Guy A. Moffett, recently appointed assistant manager of engineering of **General Electric Company's** control division, died recently after a short illness. Mr. Moffett, who was 50 years of age, had been a GE employee for nearly 27 years.

Coming Meetings

Apr. 30-May 4, National Materials Handling Exposition; International Amphitheatre, Chicago.

May 23-24, Fifth annual convention, the **American Society for Quality Control,** Hotel Cleveland; clinics and training sessions, Cleveland Public Auditorium. Cleveland, O.

June 11-13, symposium on analysis and metallography of titanium, sponsored by Armour Research Foundation of Illinois Institute of Technology; Sheraton Hotel, Chicago.

June 14-16, symposium on surfaces, sponsored by Armour Research Foundation of Illinois Institute of Technology; Sheraton Hotel, Chicago.

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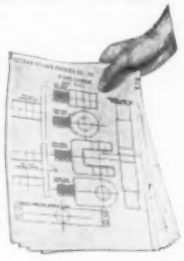

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INDICATE A-5-102

Abstracts Of Foreign Technical Literature

By M. Kronenberg

England: Surprisingly little research has been done to determine "drawability" of metals, according to a paper published by R. W. Evans in the March 9, issue of *The Engineer*. The author indicates that no test is available for correlating drawing behaviour of the blank under the press to its own mechanical and chemical properties. The article, presented before the Institute of Mechanical Engineers, London, was prepared in order to convey to tool engineers, and particularly to the deep drawing specialist, some idea of the difficulties with which the steel producer has to contend. The author covers the relationship between macrostructure, microstructure and drawability, and has included in his paper numerous diagrams on the relationship between yield-point and Rockwell hardness which he prefers as a fairly reliable approximation for determining drawability. He also discusses the appearance of the so-called "Lueders Lines" (stretcher strains), age hardening and means to prevent aging difficulties.

An autographic method of checking micrometer screws is the topic of a communication from the National Physical Laboratory as discussed by R. H. Rolt in *Engineering* published on March 9. This laboratory, corresponding to the American Bureau of Standards, was asked to develop a method for continuously recording errors of micrometer screws from one end of travel to the other.

The new method, which is confined to checking pitch of the screw in the nut, compares the travel of the micrometer spindle with that of a master screw and displays the difference as a trace on a moving strip of paper.

One of the main obstacles that has hitherto hindered the production of milling cutters by casting methods has been the difficulty of obtaining uniformity of structure. During extensive research at BSA Tools Ltd., Birmingham, which is discussed in *Machinery*, London, of March 15, it was discovered that an alloy steel of 1.3 percent carbon and 13 percent chromium with small amounts of tungsten and vanadium possesses excellent casting properties.

Cast cutters require very little machining and teeth can be produced having any shape in any direction. The staggered side and face type cutter with opposite helix angles on alternate teeth is a good example. Photos of the spheroidized microstructure of the teeth of such cutters reveal a great similarity to the microstructure of a normal hot worked high speed steel cutter. Cutting speeds and feeds are therefore similar to those used in the case of high speed steel milling cutters.

Great interest in a systematical analysis of hyraulic circuits and controls for machine tools is indicated by the fact that, almost simultaneously, two papers were published covering this subject. One in Great Britain, the other in Germany, as discussed later on in this column.

In the British publication *Machinery* of February 15 and 22, H. C. Town presents an analysis covering balanced circuits, control of multiple circuits, servo operations, electro-hydraulic operating systems and many other items.

France: A simple device for measuring torque and thrust in drilling operations has been developed by A. Mettaner according to his publication in *Le Génie* civile of October 1, 1950. The torquemeter consists substantially of a pendulum attached to the workpiece by a wire or cord. The mass of the pendulum can be varied until equilibrium between torque and mass has been established. The magnitude of the mass and the deviation of the pendulum from the vertical are used for determining the torque exerted by the twist drill on the workpiece.

Germany: An extensive investigation of the machinability of laminated plastic has been carried out by H. Schallbroch and P. V. Doderer according to their report in *Zeitschrift des Vereins Deutscher Ingenieure* of February 11. Plastic materials cause considerably heavier wear of the tool than metals, and therefore machinability is very different. The tests included turning, milling, drilling, planing of plastics standardized in the German Standard #7706 and 7707.

The authors developed a method for approximate measurement of the tool temperature which could not be determined by thermocouples. They compared the tool life in the case of machining plastics with that of machining steel and assumed that temperatures causing the same wear would be approximately the same. They concluded that temperature at the tool is very low in comparison with other materials since, at a cutting speed of 100 fpm

under otherwise identical conditions, plastic reached 175 deg F while steels were 840 deg F.

The wear land on the tool after 5 minutes of cutting at 300 fpm, with a feed of 0.008 in. and a depth of 0.080 in., was as large as 0.012 in. on one type of plastic and 0.008 in. on the other. This was more than twenty times the wear encountered when machining brass at the same speed, depth of cut and feed.

The cutting speed-tool life relationship was again found to be a straight line on log.-log paper. Carbide tools were substantially better than high speed steel tools. A wear land of 0.040 in. was reached at 600 fpm cutting speed after 150 min. with carbide tools as against 1 min. with HSS tools.

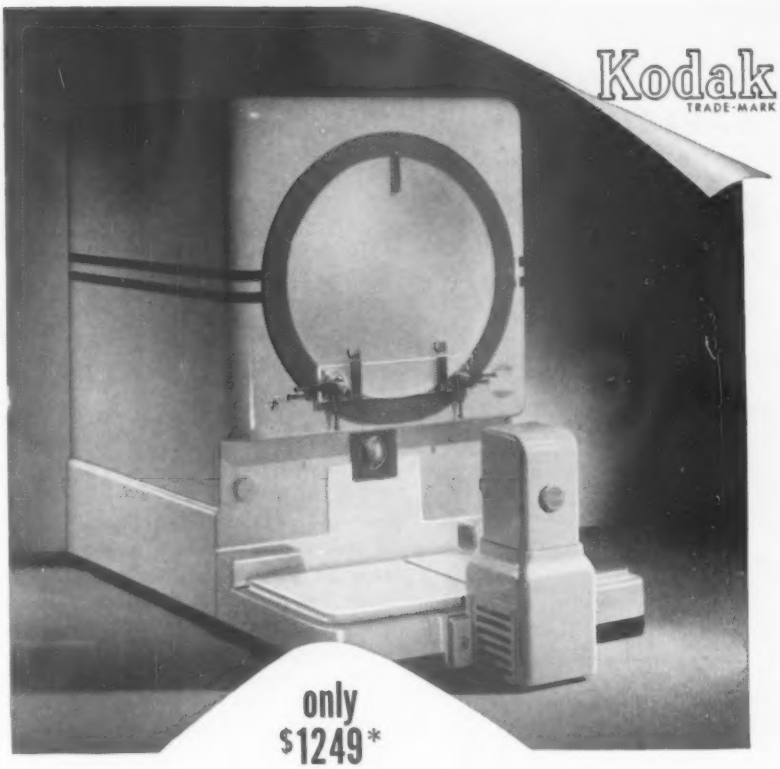
The specific cutting force is roughly 1/10 of the cutting force of steel. The authors also investigated surface finish, indicating that speed does not affect the roughness. The chip formation is entirely different from that of metals known in Europe as "tear chip" "shear chip" and "flow chip," respectively.

"Flame-Hardening of Cast Iron" is the topic of a paper by H. W. Groengess published in *Stahl und Eisen* of March 1. In tests to improve the strength of cast iron and the surface wear by flame hardening methods similar to those used on steel, he found that flame hardening was particularly successful when the graphite was fine and evenly distributed and also when castings of Meehanite D and C were used. Hardness after heat treatment was as high as 550 Brinell. Flame hardened cast iron has a high damping capacity and its fatigue limit approaches that of steel. The process and the test have been limited to large workpieces such as machine tool beds, crankshafts, cam shafts, large cylinders and similar parts.

A. Duerr has published an article in *Werkstatt und Betrieb* No. 4, 1950, on "Hydraulic Control of Machine Tools". The author indicates that an analytical description of hydraulic controls of machine tools is still missing although an analysis has recently been published covering hydraulic drives of machine tools.

His paper, which was presented before the annual meeting of Verein Deutscher Ingenieure, represents a first step in this direction. Single purpose machines and tracer controlled machines are the two main classifications which he suggests, subdividing them into nineteen classes, such as hand operated, cam operated and hydraulically operated pump controls, hand operated valve controls, etc.

On this basis the author investigates the differences and similarities of the various hydraulic controls in machine tools, explaining details by means of numerous drawings and illustrations.



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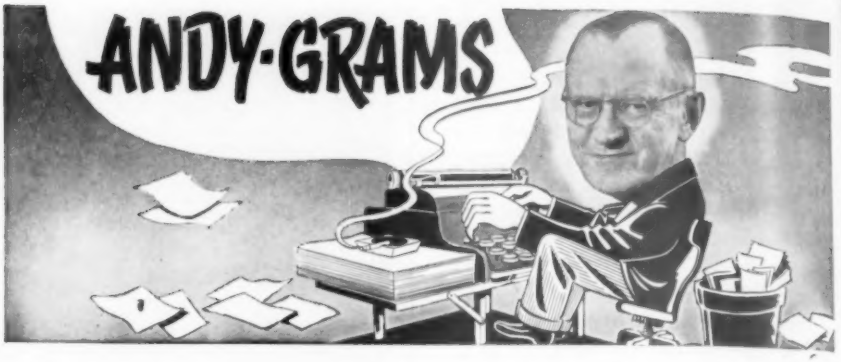

What with other matters and the space at my disposal, the best I can do is a thumb-nail sketch of the '51 Annual which, in my opinion, was one of the best in ASTE history. Not so much in attendance, perhaps, although there were no grounds for complaint on that score, but certainly so in the calibre of the technical sessions. My heartiest congratulations to the host chapter and all others responsible for the Convention.

Going, found myself car mate with Marvin Anderson, Paul Zerkle and the rest of the brass from Michigan Tool Co., and so learned (I hope) gin rummy at no cost. Then, warmed by a friendly reception from ASTEers N.E.W.S. at the meeting, had a wonderful time. In this connection—and now is the time to say it—I am fortunate in knowing some of the finest people on earth, and with these the ASTEers belong in the top drawer. It's nice to have known you.

For the record, Bill Smila still has his shirt albeit I managed to fray it a bit. But, there'll come a day! Coffeying between sessions, a jabberwocky with Les Bellamy and Jay Bowen, then, at dinner Thu. nite, was made a temporary member of Worcester chapter by invitation of Vic Ericson. Nice people, the Worcesterites. A smorgasbord at the Gripsholm with Clarence Etter; kicked downstairs in a gift shop by a woman (she fell first and knocked my pins from under me); and a wild taxi ride chauffered by a driver with quick reflexes. Never a dull moment!

Reminiscences of "them days" with old timers. Milt Kline and Lamar Brant of Ft. Wayne sprinkled salt on one of my tales, but if somebody can round up Emil Gustafson, last heard of around Lynn, Mass., he'll confirm with probably some added. With the aspersion cast on my veracity, however, I refrained from telling 'em about the time it rained fishes. (Note to Ed Berry, Li'l Rhody—and thanks for the cigar, Ed, it was okay: please look up Providence Journal for ca 1900 and see if you can't find the mention, or maybe the Olneyville Courier or whatever it was called. Thanks a lot) These boys from Missouri, they've got to be shown.

Frank Shute of New Haven, with reminders of lobster; Jack Green, with greetings from Portland, Me., George Donnelly of Boston, with reminiscences of Taft-Pierce days; Floyd MacArthur of Twin States, looking fine; Damon Ray Morris sans Pythias Clete Briner, the latter an absentee among the past-prexies; "Choremaster" Carl Van Ausdall; John Dukolie, with ideas for gadgets; a smile with friendly Frank Martindell; a long-time-no-see-since Montreal with Biff and Mrs. Pender, and so on and on.

A tough choice between outstanding candidates precipitated a few upsets in the national slate, none of which reflected on individuals. There's always another year. Jake Demuth, elected prex, stole the show with his inaugural speech at the banquet and further distinguished himself by his choice of com'tee ch'men, including Bill Jarvis who'd been hiding under a bushel.

A rousing welcome for Senator ASTEer Ralph Flanders, and an ovation for the choral group from Union Twist Drill Co. Good public relations stuff that could well be emulated. Going home, a chat with Athel Denham who, in my opinion, is doing a swell job for the Society, then, back in Detroit to face a final blast from Boreas. Wished I'd gone with the luckies to Bermuda.

Just before leaving for the Convention, had a visit from Edvard Johansson, son of the late C. E. Johansson, wizard of precision. A real guy, who, I hope, will respond to my invitation to join the ASTE. He belongs. Which reminds me: Congrats to member-at-large Erik Larson on 50th anniversary of Albin Motors, Sweden, of which he is prex; also, thanks to Bill Sjostedt for copy of *Industria International*, which I enjoyed.

My return to Detroit coincided with the passing of Harold Norberg and so, with a gathering that included a number of ASTEers—among them honorary pall bearers—I observed the final services for a friend who, while not a member, had nevertheless been a warm supporter of the Society. President and general manager of the Plan-O-Mill Corp., president of the Jansson Gage Co.

and the Norberg Tool Co., Harold was held in high esteem by a host of friends.

Looking back, I am rather glad that, just before leaving for the Convention, I had sent him a personal greeting. In the rush of life we don't always think of those things, or if we do, put the action off until tomorrow. But having done them, it's nice to know what the thought didn't come too late. Happy landings, Harold; I know that you'll make the Goal.

Well, the show must go on in spite of personal bereavements, apropos which Ray Putnam, likeable young business manager of The Tool Engineer, attended the Convention hard on the heels of the sudden demise of his father. In behalf of his associates on the staff and at Society H.Q., our sincere sympathies in his bereavement.

Coming back to the convention, and apropos nothing in particular, I can quite agree that the tool engineers have done an outstanding job in tooling for both peacetime and wartime production, and that we will do as good if not a better job in the present defense program. Yet, while it is true that we have contributed our share toward invention and industrial progress, we musn't forget that, in the main, our job is to tool the products designed by engineers in other fields. So, let's give due credit to the M.E.'s and E.E.'s and all others who are also contributing their know-how to industrial and national progress.

In this connection, although perhaps a bit afield, I am wondering why students in the so-called accredited colleges should be deferred for military service over students in technical schools which, while not accredited by the North Central Association, are nevertheless doing an outstanding job in training men for tool engineering. Few if any engineering companies engaged in tool engineering that don't have executives and leaders, let alone the majority of board men, who are graduates of these unaccredited colleges.

Now, with demand for trained tool engineers at a peak, and with about every newspaper in the country jammed with display ads for trained men it seems that major consideration should be given students of these schools. Not that I'm playing favorites as far as the selective service is concerned, but if we are short of tool engineers then the way out is to train them. There's the thought; now let the brass take over.

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Andy

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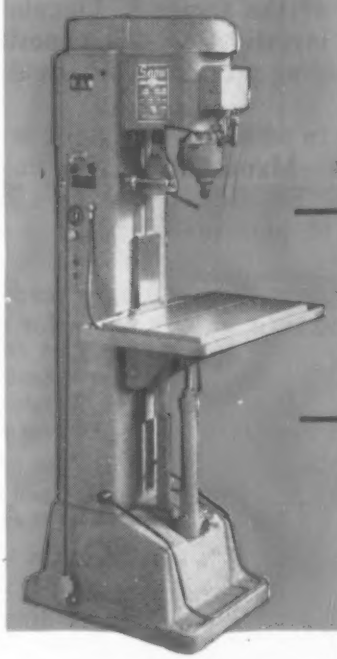

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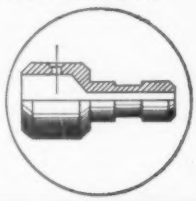
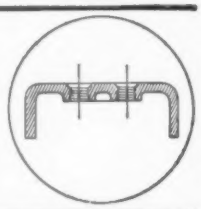


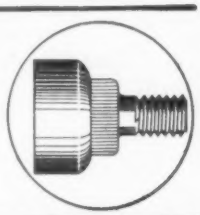
Crossdrill and C'T" Sink 1/16" Hole
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

TAPPING



Tap Two #10-32 Holes
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING



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Equipment—#3-TR Threading machine

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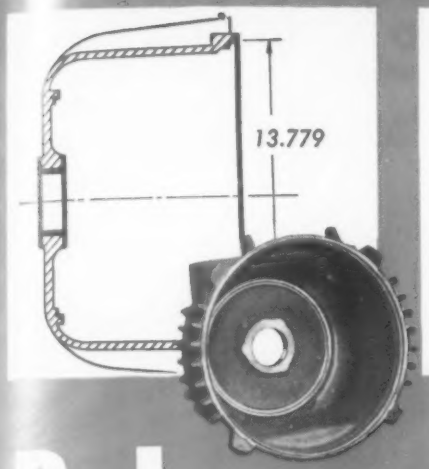

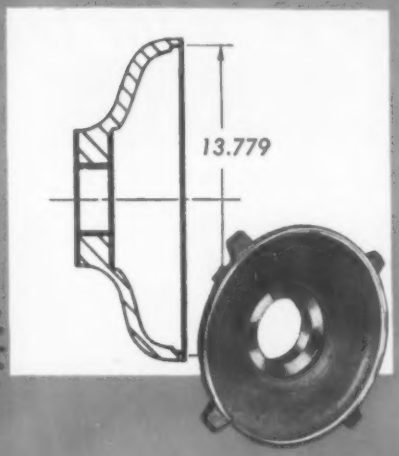

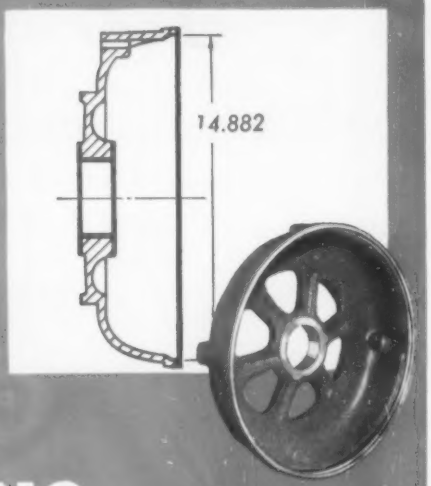

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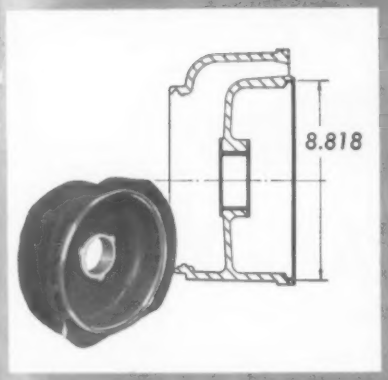

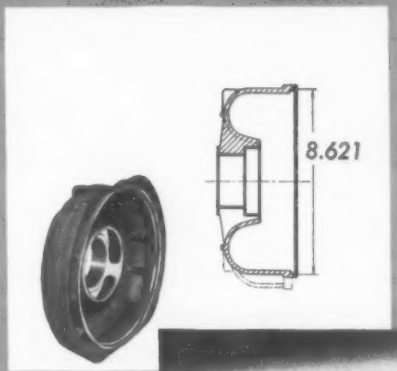

THESE several types of motor brackets require similar machining operations, as indicated by heavy lines in the drawings. Two P&J Automatics speed up this class of work — Models 5DE and 6DRE. Experience and full understanding of their capacities and versatility permitted P&J Engineers to design similar tooling setups for both machines.

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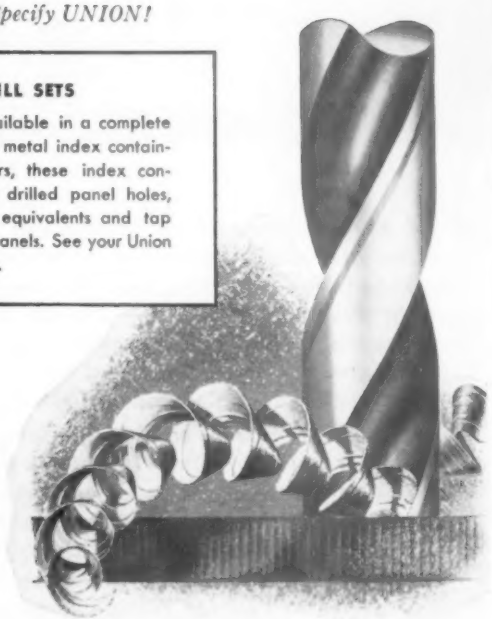

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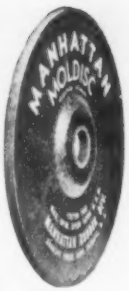

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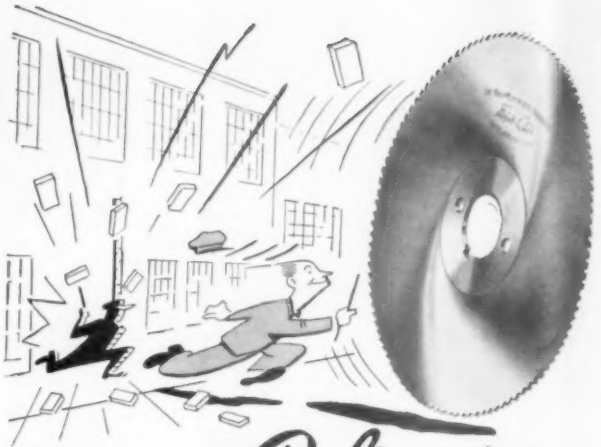

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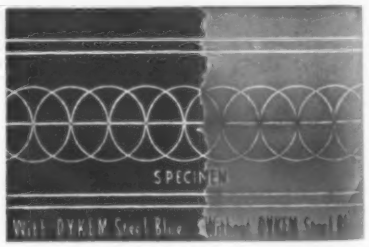

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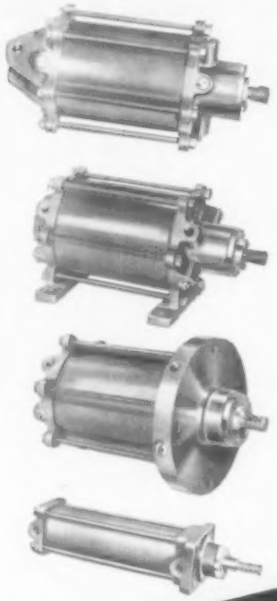

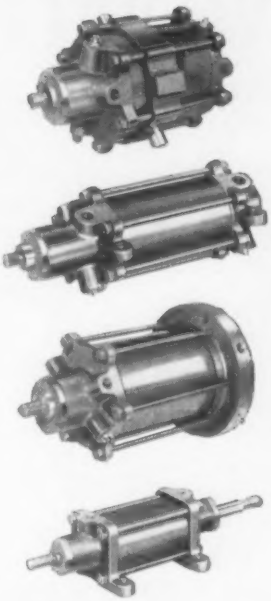

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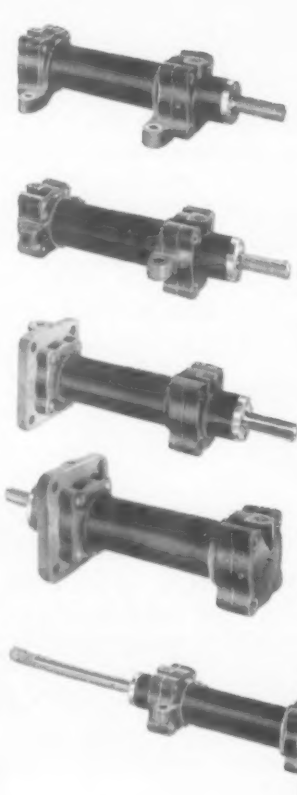

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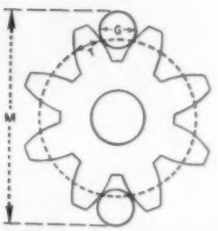

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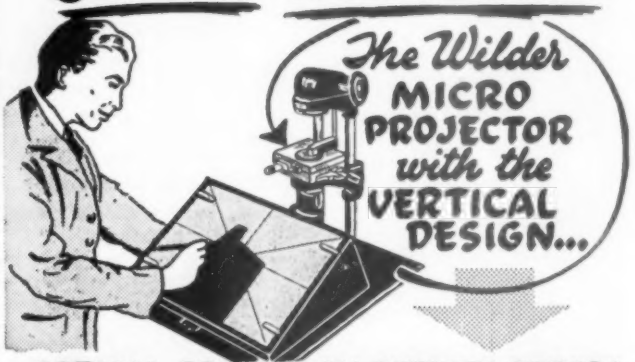

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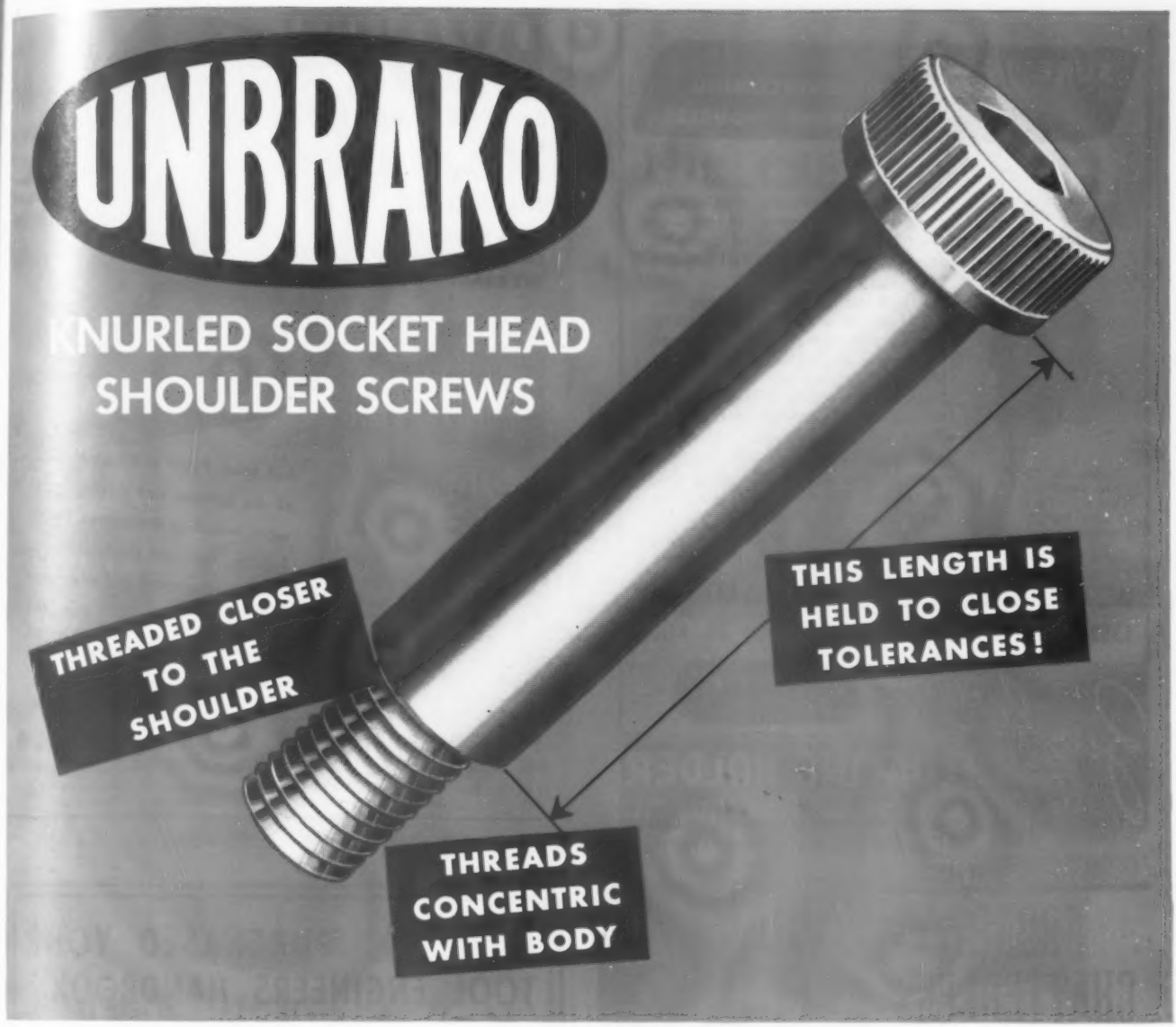

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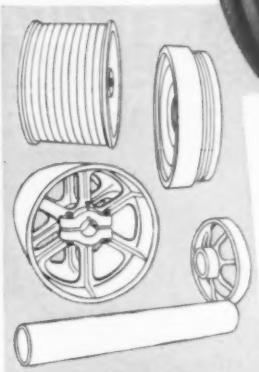

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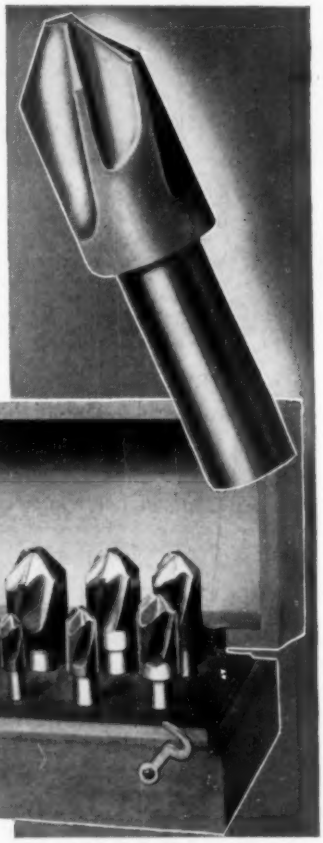

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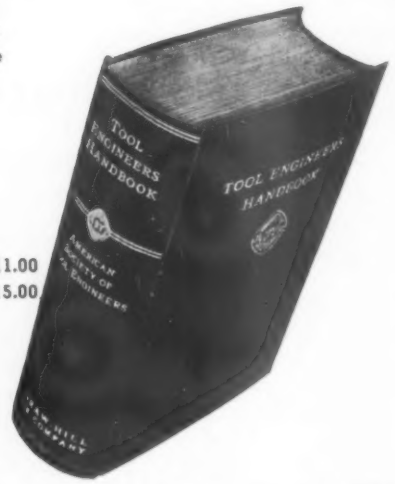

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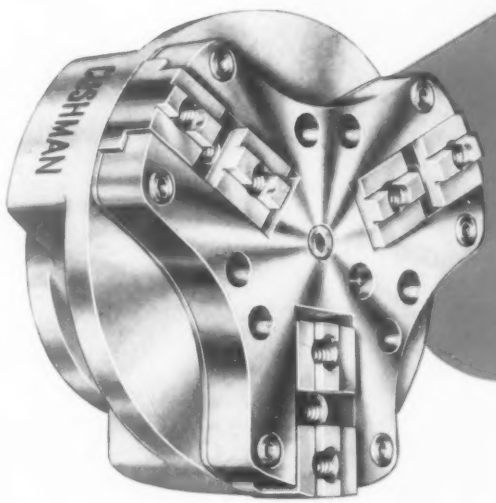

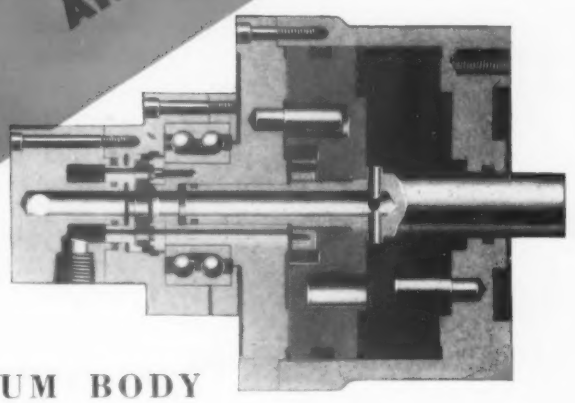

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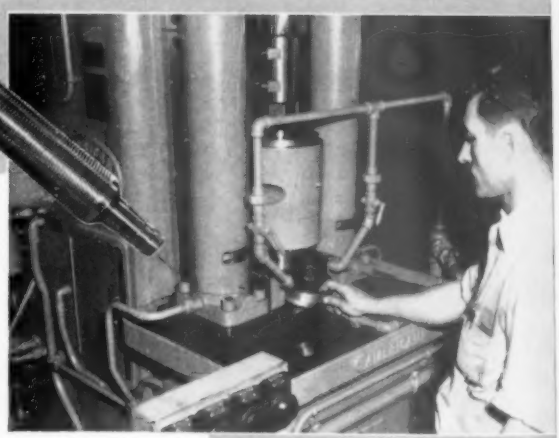

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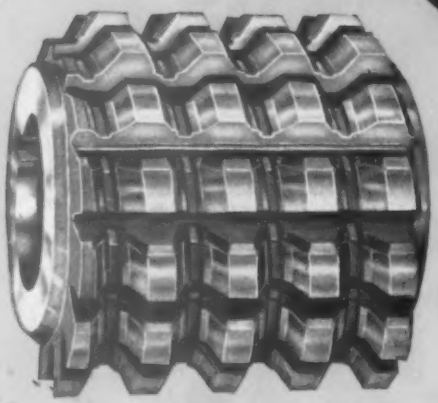


HOBS
(CARRIED IN STOCK)

The latest A.S.A. Involute Spline Standard—B 5.15-1950—makes proper tooling essential to standard involute spline production . . . and Illinois Tool Works offers the *only complete selection* of the hobs, broaches and shaper cutters required. Take advantage of single source tooling responsibility and the experience of the same engineers who helped to formulate the standard. Come to Illinois Tool Works for your involute spline cutting tools.

WRITE FOR YOUR FREE COPY TODAY!

- ✓ the latest official standards information from A.S.A. Standard—B5.15-1950
- ✓ engineering specifications and ordering data on hobs, shaper cutters and broaches
- ✓ tooling recommendations for maximum production efficiency

SHAPER CUTTERS

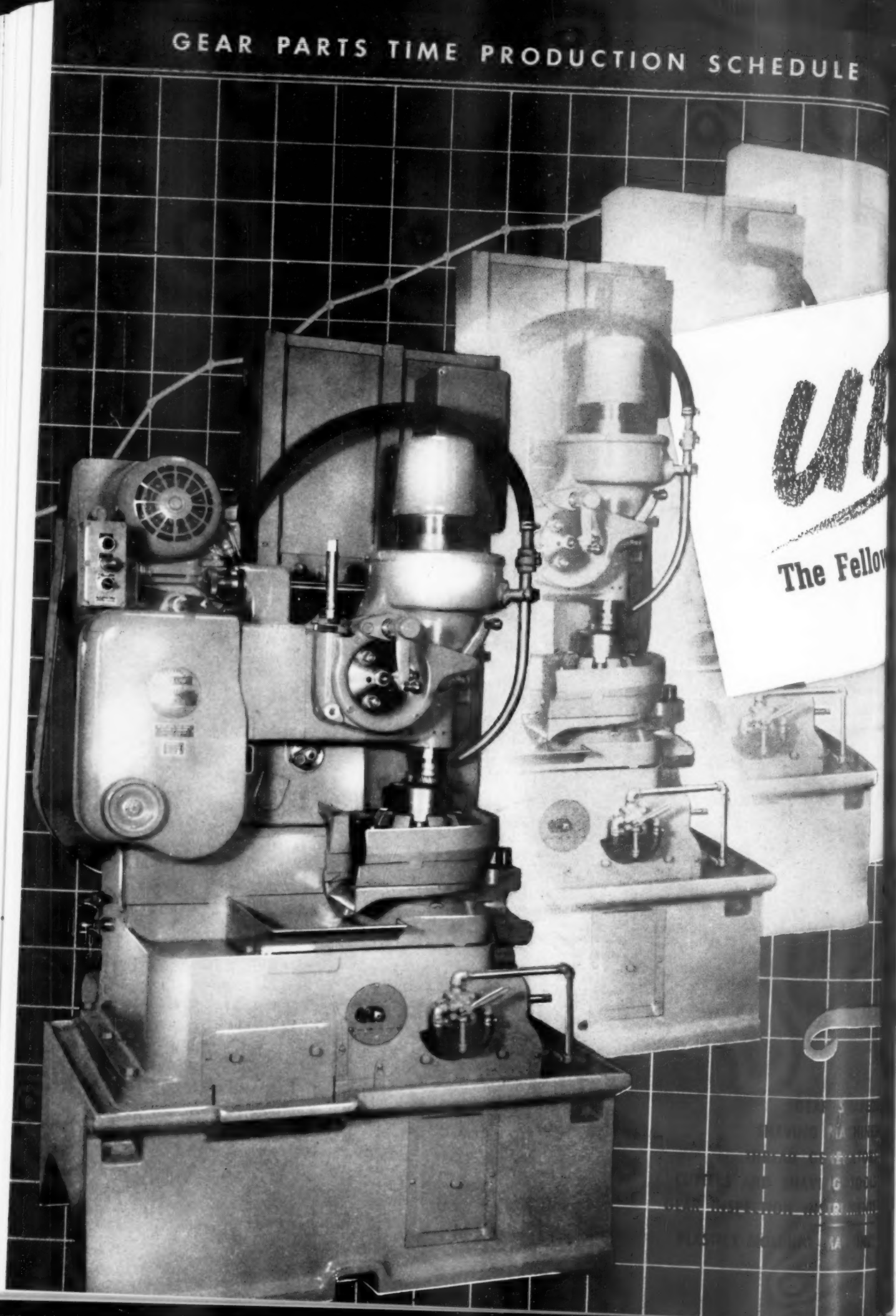
ILLINOIS

TOOL WORKS

2501 North Keeler Avenue, Chicago 39, Illinois
In Canada: Canada Illinois Tools Ltd., Toronto, Ontario

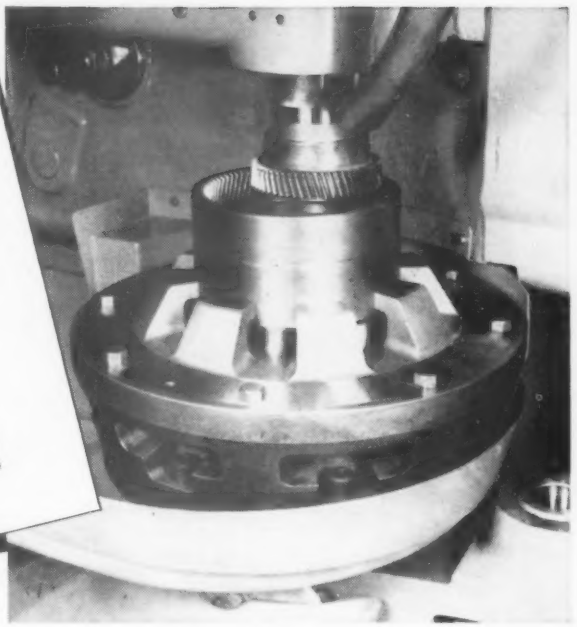
ILLINOIS TOOL WORKS • BROACHES INC.

"Headquarters for Engineered Cutting Tools"


The Fellow

GO TIME SAVING POSSIBILITIES

7A-Type Gear Shaper sets a Production Pace for 1951



For an internal gear part an air-operated diaphragm-type chuck like this makes loading and unloading a simple operation—for stop-watch timing.

- **AUTOMATIC QUICK-STOPPING OF CUTTER-SPINDLE RECIPROCATION**
- **AUTOMATIC POSITIONING OF CUTTER AT TOP OF STROKE (without coasting)**
- **AIR-OPERATED QUICK CLAMPING CHUCK**

Due to its amazing versatility, the 7A-Type Gear Shaper is able to compete with other production machines on a floor-to-floor time saving basis. High cutting speeds and precision control have always been there. To these advantages have been added speed-up of work handling, quick-acting work holding devices, etc.

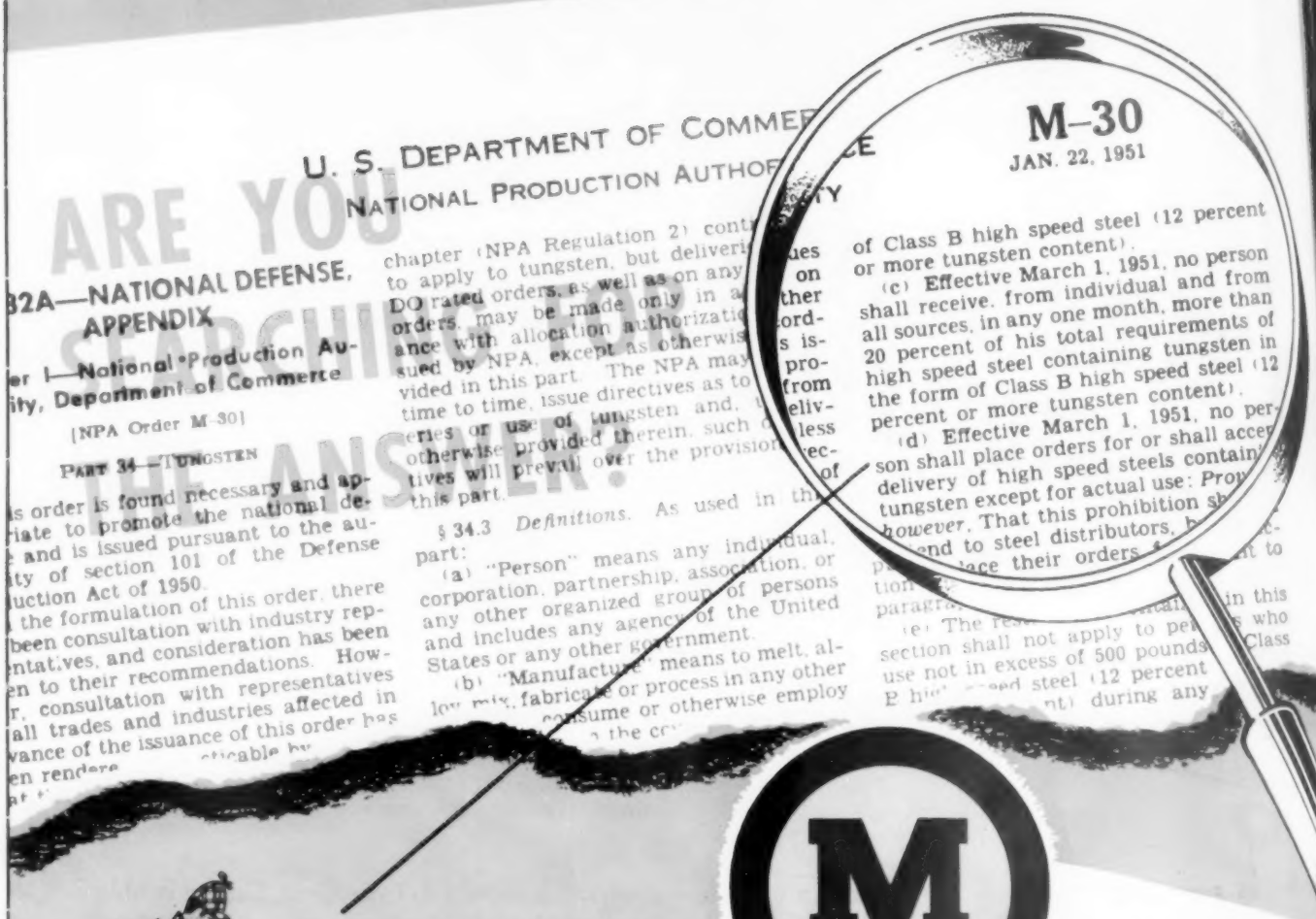
The machines illustrated are set up to cut cast iron internal helical gears 27/32″ face width, 16 pitch, 20° pressure angle, 79 teeth (5.1313″ p.d.)—and to finish each gear in 2 cuts in 5 minutes floor-to-floor time.

If your requirements are not sufficiently large to require the enormous production possibilities of the 10-spindle Rotary Gear Shaper, let us work out time estimates based on 7A-Type Machines with the latest auxiliary modifications. Write, wire or phone the nearest Fellows engineering-sales office.

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont

Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 2206 Empire State Bldg., New York 1.


U. S. DEPARTMENT OF COMMERCE
NATIONAL PRODUCTION AUTHORITY
M–30
JAN. 22, 1951
32A—NATIONAL DEFENSE, APPENDIX
[NPA Order M-30]
PART 34—TUNGSTEN
§ 34.3 Definitions. As used in this part:
(a) "Person" means any individual, corporation, partnership, association, or any other organized group of persons and includes any agency of the United States or any other government.
(b) "Manufacture" means to melt, alloy, mix, fabricate or process in any other
(c) Effective March 1, 1951, no person shall receive, from individual and from all sources, in any one month, more than 20 percent of his total requirements of high speed steel containing tungsten in the form of Class B high speed steel (12 percent or more tungsten content).
(d) Effective March 1, 1951, no person shall place orders for or shall accept delivery of high speed steels containing tungsten except for actual use: Provided, however, That this prohibition shall not apply to steel distributors,
(e) The
section shall not apply to persons who use not in excess of 500 pounds
during any

ARE YOU SEARCHING FOR THE ANSWER?

Here's the Answer...

CIRCLE M

Memo

TO---Users of High Speed steel
SUBJECT---Experience with Moly Steel

Firth Sterling has been known for years as a leading producer of the tungsten types of high speed steels. The tungsten steels Circle-C and Blue Chip are world famous and Firthite, sintered tungsten carbide, is used in metal working shops everywhere...

BUT ... 47% of Firth Sterling's 1950 production (a record peacetime year) consisted of Moly-type steel.

For "at least 80% of your high speed steel requirements", Firth Sterling offers these fine quality steels:

Circle-M Super High Speed Steel — the PREMIER Moly-Cobalt high speed steel (Type M-36). This steel can be used at 20-25% higher speeds than used for ordinary high speed steels. Circle-M has a good red-hardness value and is highly abrasion-resistant. Write for Bulletin SL-2032.

Star-Mo M-2—an improved 6-6-2 tungsten-molybdenum type of high speed steel developed for general use on machining operations. Write for Bulletin SL-2015.

Hi-Mo High Speed Steel — the standard 8-4-2 moly-chrome-tungsten type that has the combined features of excellent toughness and low hardening heats.

Firth Sterling

STEEL & CARBIDE CORPORATION

MILL: McKEESPORT, PA.

GENERAL OFFICES: 3113 FORBES STREET, P. O. BOX 71, PITTSBURGH 30, PA.

Offices and Warehouses:

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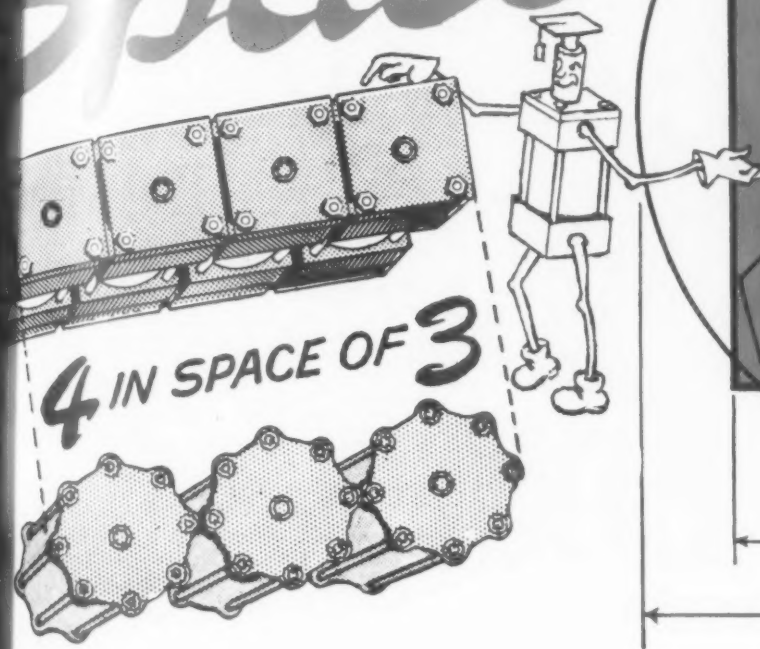
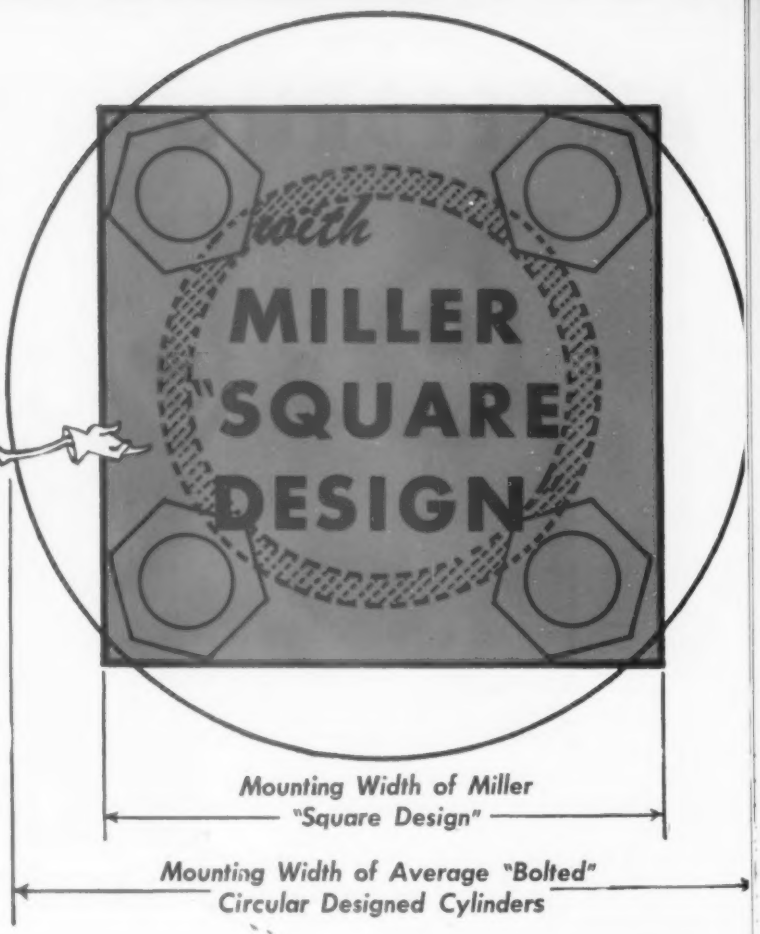
ave Space





Air and Hydraulic CYLINDERS...

Miller
TRADE MARK REGISTERED

Benefits to You!

- More Cylinder Power in Same space
- Solve "Limited Space" Problems
- Simplify Designing and Installation
- Save hours of Drafting Time

The SQUARE DESIGN of Miller Cylinders saves up to 25% of mounting space, permitting more cylinder power in the same space and easier, more convenient installation in "tight spots." Thus, in many cases, machines and equipment can be designed more compact and less costly by using Miller Cylinders. Hours of drafting time can be saved — as only a few straight lines show any view on drawings.

The illustration at upper left shows graphically how *four* Miller Cylinders can be mounted, bore for bore, in the same space required for *three* average "bolted" circular designed cylinders. Some Miller bore sizes permit even greater space-savings.

Other important *standard* features of all Miller Cylinders include: solid steel heads, caps and mountings, hard chrome plated piston rods, dirt wiper seals, and other "quality" features as shown in illustrated bulletins sent FREE on request. Remember, too, that Miller Hydraulic Cylinders (2000-3000 psi) meet the J. I. C. Hydraulic Standards.

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LO PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES F 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES 2000-3000 PSI OPERATION. MOUNTING STYLES AVAILABLE.

Miller

MILLER MOTOR COMPANY

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AIR AND HYDRAULIC CYLINDERS - ACCUMULATORS - COUNTERBALANCE CYLINDERS - BOOSTERS - AIR HOI

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HARTFORD — NEW YORK CITY — DAYTON — ST. PAUL — FORT WAYNE — INDIANAPOLIS
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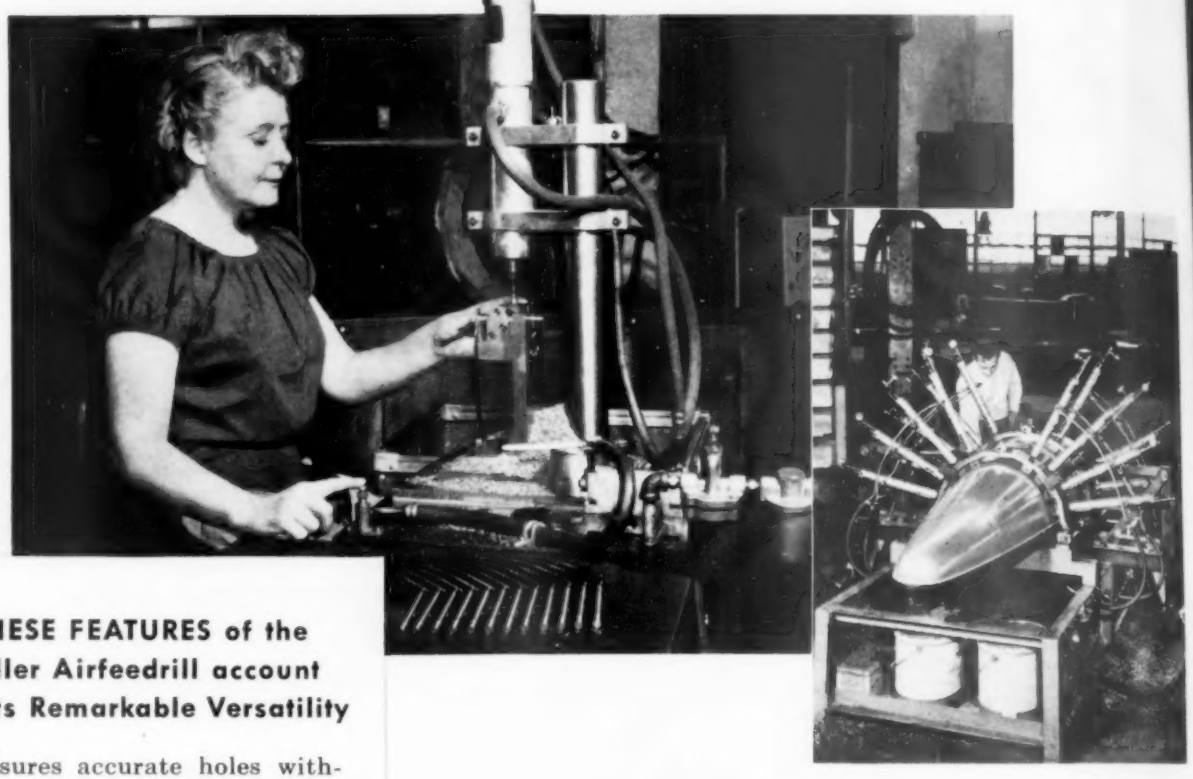
ST. LOUIS and OTHER AREAS.

les and Service from coast to coast

AIRFEEDRILL* for low cost, rapid sequence drilling



THESE FEATURES of the Keller Airfeedrill account for its Remarkable Versatility

- Assures accurate holes without costly fixtures . . . can be used with existing jigs
- Attaches in any position and supports itself at any angle
- Operates and is controlled entirely by air . . . with pneumatic cycling to speed production, reduce operator fatigue
- Small size permits it to be used on close centers and in tight places
- Accurately drills parts too large for conventional drilling machinery
- Wide range of speeds and strokes will accommodate light or heavy metal, wood, composition, plastic
- Lightweight portable and stationary models are readily adapted to changing job requirements . . . quickly shifted from job to job

INTERMITTENT, short run drilling jobs need not be handicapped because of their infrequency or short length of run. They can be handled easily and at low cost when you know the capabilities and versatility of the Keller Airfeedrill.*

Illustrations above show two instances where Airfeedrills have been mounted inexpensively to meet such production needs. At the touch of a button, the Airfeedrill advances, drills, retracts, and shuts off automatically—drilling accurate holes as fast as an operator can load and unload the fixture.

Perhaps Keller Airfeedrills can simplify production for you. Have you seen the descriptive booklet—"The Hole Story of the Keller Airfeedrill?" You will find it interesting to read.

*Keller Tool Company Trade Mark

KELLER TOOL COMPANY
GRAND HAVEN, MICH.

KELLER *Pneumatic Tools*

Could a wheel do it better?

A widely accepted method of finishing many parts and tools is by application of an abrasive belt of certain specifications. Yet, it is entirely possible that an improved method may some day be devised—the use of a special-type abrasive wheel, for instance... on a new type of polishing wheel.

Should this ever occur, CARBORUNDUM would undoubtedly be among the first to produce the right wheel. But, *even more important,* we would be fully prepared to explain the pros and cons of both methods. Because only CARBORUNDUM makes a *complete* line of abrasives...we can recommend *impartially* the right abrasive for every application based on our experience with all abrasive products.

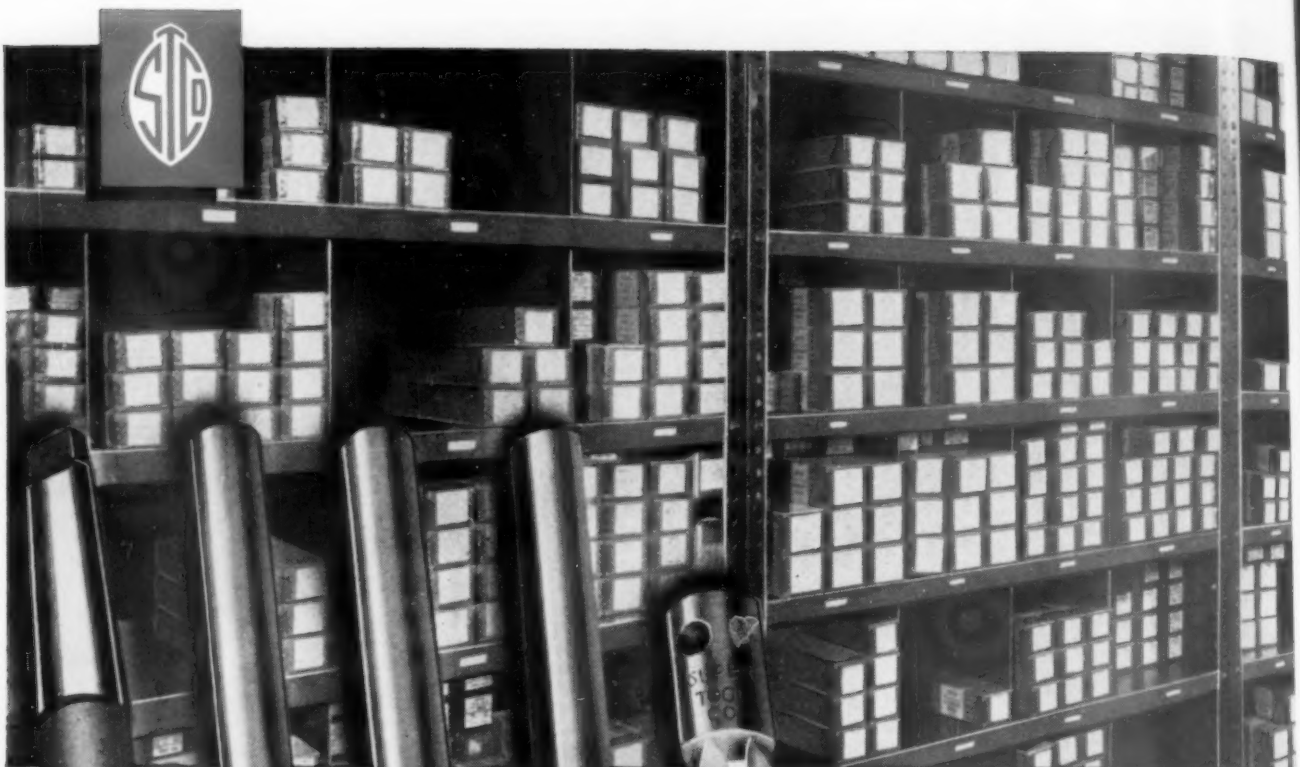
Perhaps the past few years have brought new developments in abrasives of which you are not aware—developments which could provide increased production, efficiency and economy for you. Your CARBORUNDUM representative will gladly give you impartial technical advice on proper application to your processing.

Only CARBORUNDUM

TRADE MARK

makes ALL abrasives to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, N. Y.



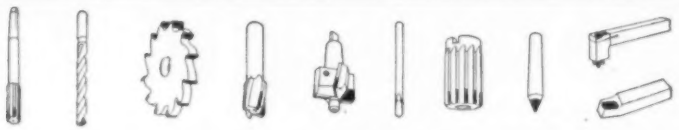
Super

CARBIDE TIPPED

REAMERS

in a complete range of types and sizes carried in stock to simplify your tooling job.

Write for our Catalog No. 50



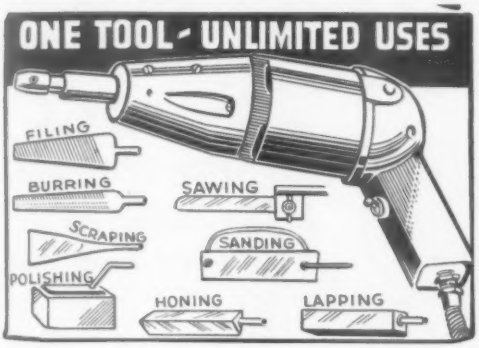
QUALITY CARBIDE TOOLS

Super TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California

B-R-E-A-K . . . .
Hand Finishing Bottlenecks

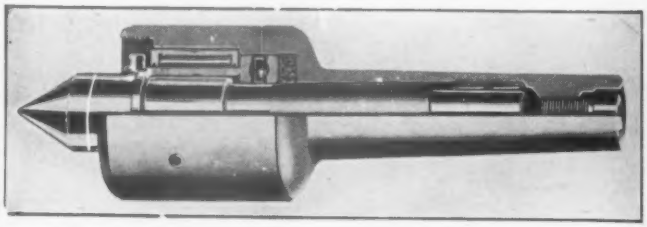
with PORTABLE - ELECTRIC
RECIPROCATING TOOLS



These handy tools will cut out many tedious hand filing and finishing operations — Increase Production—Produce Uniform Work.

Light in weight — Delivers 1/8" or 3/8" fixed stroke at 1000 strokes per minute—operates on 110 volts AC or DC.

NOW . . .
Give Production a Lift!



Boost production of high speed turning operations. Use MOTOR TOOL LIVE CENTERS (Ball and Roller Bearing). The only center with the RED BAND OVERLOAD INDICATOR, which prevents overloading of thrust bearings.

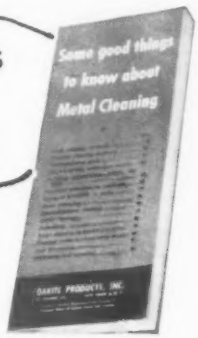
Designed for long trouble-free operations, MOTOR TOOL LIVE CENTERS require minimum care for maximum production.

Write for bulletin giving all the advantages of these Live Centers.

PRECISION PRODUCTION TOOLS
ACME TOOL COMPANY
75 West Broadway New York 7, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-125-1

WHICH SOILS ARE HARDEST TO REMOVE?



- ☐ buffing compound residues
- ☐ pigmented drawing compounds
- ☐ oils and greases
- ☐ heat scale
- ☐ rust, oxides
- ☐ carbon smuts
- ☐ tarnish
- ☐ flux residues
- ☐ rust preventives

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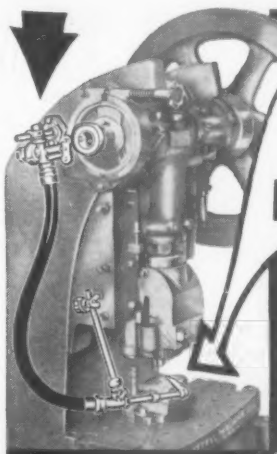

keep HANDS and FINGERS away from PRESS RAM

LITTELL
Air Blast Valves
Eject Automatically by Air . . . not by Hand

SAVE TIME . . .	. . Faster production and lower labor costs
SAVE AIR . . .	. . Reduce air consumption 92 percent
SAVE DIES . . .	. . No damage to dies due to clogging
SAVE HANDS . . .	. . Keep operators' hands and fingers out of danger zone
SAVE MONEY . . .	. . Insurance premiums are lower when accidents are reduced.

QUICKLY INSTALLED—Littell Air Blast Valves can be installed on any make or size press in only a few minutes.

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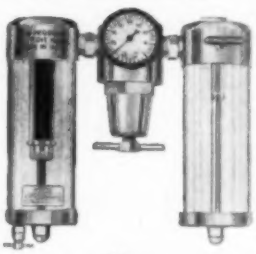
Air Line **FILTER, REGULATOR and LUBRICATOR ASSEMBLY**

"Sentinel of the Air Line"



FILTER element removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR is capable of passing large volume with an unrestricted flow and minimum amount of pressure drop. Self-bleeding, compact, simple. Machined from bar aluminum. LUBRICATOR delivers desired volume of oil. Adjustable Venturi Valve permits efficient operation on broad range of volume and pressure. Bowl can be refilled without shutting off air supply. Any of these 3 devices can be used as separate units or in any combination.

Also Pneumatic Grinders

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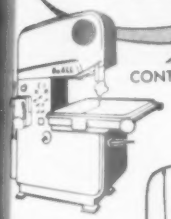
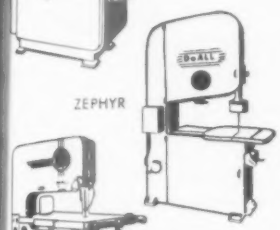
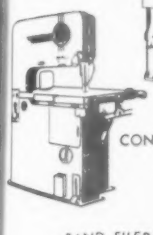
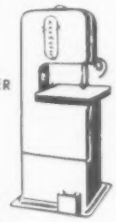
INDUSTRY'S NEW SET OF TOOLS


CONTOUR-MATIC

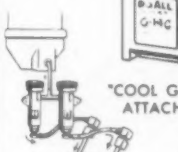

ZEPHYR

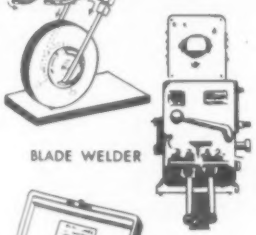

CONTOUR


BAND FILER

TOOLROOM GRINDER

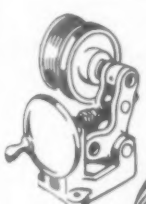
CRUSH GRINDER


"COOL GRINDING" ATTACHMENT


BLADE WELDER

GAGE BLOCKS

GAGE ACCESSORIES


VARIABLE SPEED DRIVES

SAW BANDS

National Acme Company, Cleveland, reduces cost of cams and gears. One of the first steps in production of Acme cams is splitting the ring shown above into segments. DoALL MP-20 makes cut through 9¼ x 1⅛" wall thickness in three minutes.

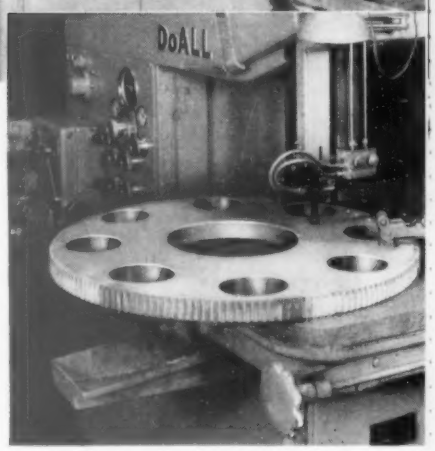
It's EASY TO SAVE . . .

MANPOWER — Hydraulic controls and power feed simplify operation and increase output. Operators attain skill in short time. Reduces labor cost.

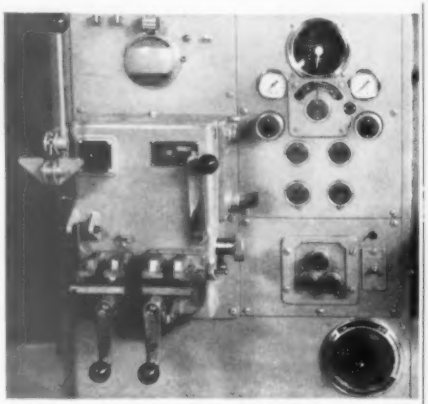
MACHINE POWER — Preliminary metal removal and shaping by hydraulic powered band machining technique saves time of more costly machines. Expanded speed range and new Band Tools cut any material.

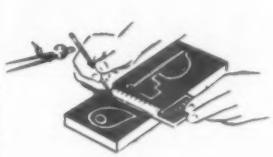
MATERIAL — Band Machining technique cuts directly to layout line, removing surplus metal in usable form in record time. Reduces scrap loss — less chips, less waste.

SEE IT DONE ON THE MODEL MP-20 — Ask our Machine Tool Specialist to demonstrate the CONTOUR-MATIC Band Machine that creates entirely new manufacturing possibilities.



Tough alloy gear 1¾" thick is split in 16 minutes "floor to floor time." MP-20 provides required band speed and feed pressure


Centralized operating panel controls speed of tool, feed pressure of table, welding the tool, and coolant facilities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BENCH FILER

The DoALL Company

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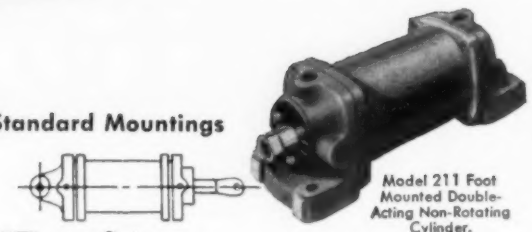
Factory Trained Representatives Everywhere

RIVETT Furnishes—

a Complete Power Package

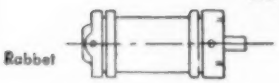
Rivett can furnish the correct valve and cylinder for any hydraulic circuit. There are nearly 300 primary models in the standard Rivett line, each available in a variety of sizes and types. Because of the simplicity of Rivett design, variations can be made to meet any unique situation.

Seven Standard Mountings

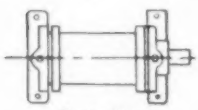


Model 211 Foot Mounted Double-Acting Non-Rotating Cylinder.

Clevis



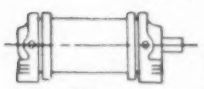
Rabbet



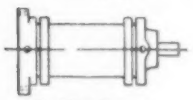
Center-Line

CYLINDERS

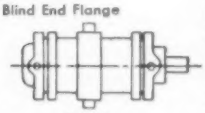
Offered in pressure ranges of 300 P.S.I. maximum, and 1500 P.S.I. maximum oil services. 3000 P.S.I. maximum service and higher pressure ranges furnished on application. Available in ten bore diameters, in strokes up to 96", with standard and 2:1 differential over-size rod; and with cushioning rod end, blind end or both. Special models supplied.



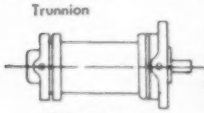
Foot



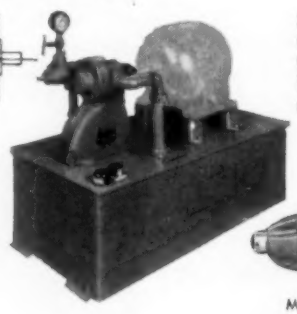
Blind End Flange



Trunnion



Rod End Flange



Model 8832 Sequence Valve

Model 8630 Cam Operated Flow Control Valve

Model 7200-1 Oil Pilot Operated Valve

Model 5605 Solenoid Pilot Operated Four-Way Valve

VALVES

Designed for oil service pressures up to 1500 P.S.I., and furnished for 3000 P.S.I. in certain models. Available in standard, spring-return, spring-centered, and ball detent action; five piston designs: hand, foot, cam, solenoid, oil pressure, and air pressure operated; 1/4", 3/8", 1/2", 3/4", 1", 1-1/4" and 1-1/2" sizes.

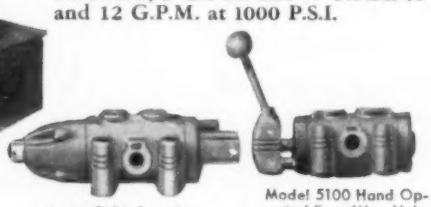
Model 5805 Oil Pressure Operated Four-Way Valve

POWER UNITS

Series 9100 single pump, in 5 tank sizes. Capacities, .4 G.P.M. to 40 G.P.M. at 1000 P.S.I. Series 9200 double pumps in 5 tank sizes. Delivery combinations, 3 G.P.M. and .4 G.P.M. to 40 G.P.M. and 12 G.P.M. at 1000 P.S.I.

Model 5900 Air Pressure Operated Four-Way Valve

Send for Rivett Catalog Sections 104 and 202



Model 5310 Cam Operated Four-Way Valve

Model 5100 Hand Operated Four-Way Valve

Model 5500 Double Solenoid Operated Four-Way Valve

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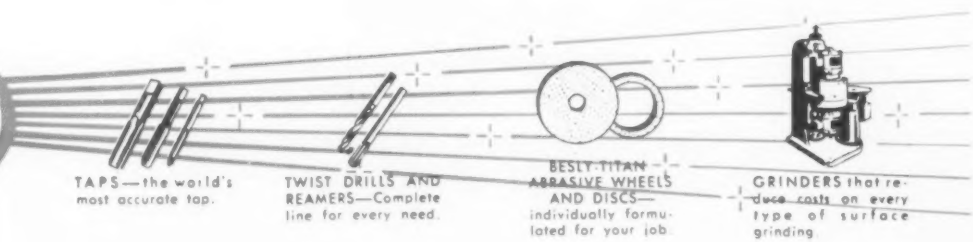

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Co-efficient of Thermal Expansion (per ° F.)	3.00×10^{-6}
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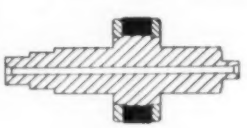
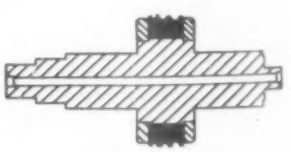


SLEEVED ROLLS FOR FLAT WIRE



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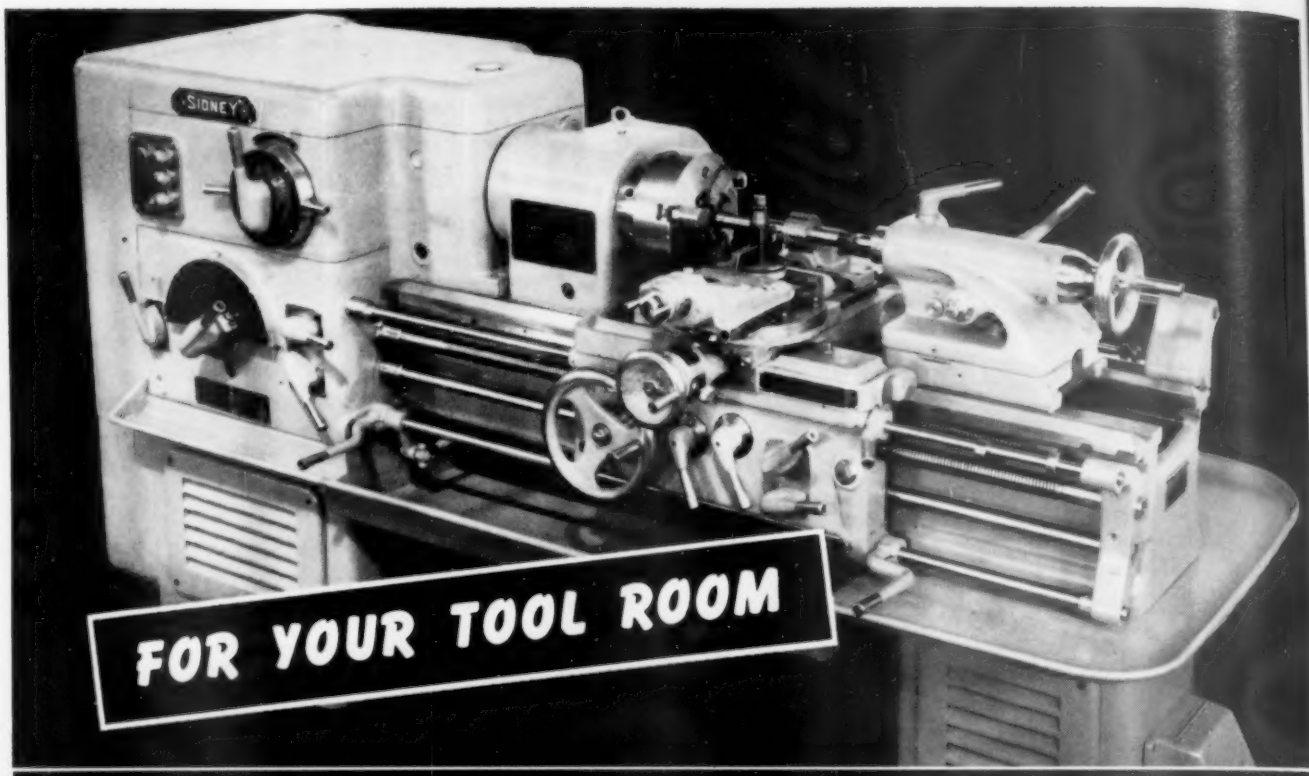

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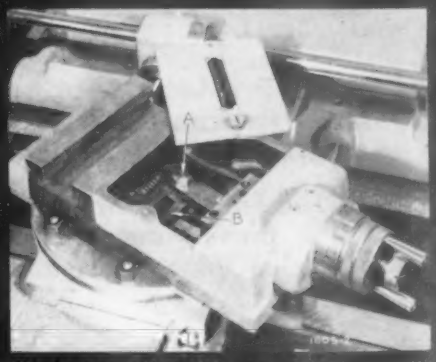
Here is an entirely new development which has many advantages over the conventional relieving attachment.

It is adaptable to Sidney Lathes already in the field as well as to new machines and incorporates a 4 to 1 spindle speed reducer integral with the change gear housing thus eliminating the need for 2-speed motors or other costly devices to reduce spindle speed. Universal joints have been eliminated entirely. A timer arrangement enables the operator to pick up any relief at any point with a minimum of effort. A clutch lever is provided to disengage relieving attachment for conventional turning.

This attachment will handle plain external relieving, spiral relieving, form relieving, end relieving and internal relieving.

For complete details write us or contact a Sidney representative.

Rear view showing change gear housing with conveniently located index plate.



Illustrates adjustable cam throw. Additional cams are not required to obtain various throws.

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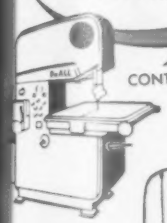
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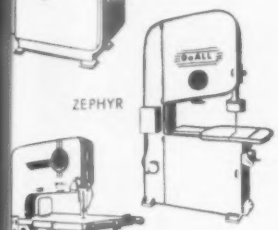
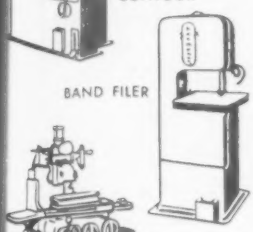
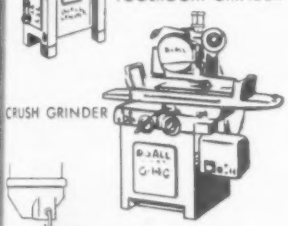

ZEPHYR

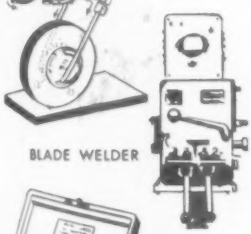
CONTOUR


BAND FILER

TOOLROOM GRINDER


CRUSH GRINDER

"COOL GRINDING" ATTACHMENT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SAW BANDS

An 8" x 14" Automotive Blanking Die made of hi-carbon, hi-chrome, air hardening tool steel at Advance Tool Stamping & Die Co., Columbus, Ohio. Shown here being sharpened.

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U. S. Patent 2470350
(Coolant-through-the-wheel)

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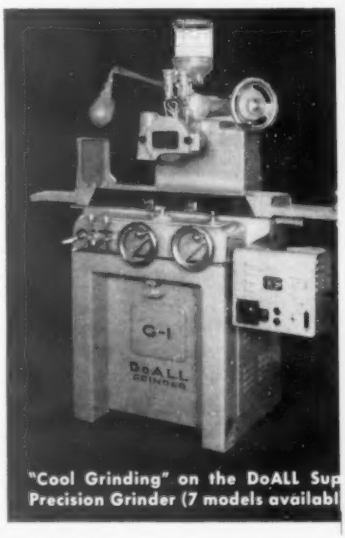
SEE ONE WORK. Call your local DoALL Store today. They'll arrange a demonstration—without obligation—of this revolutionary Surface Grinder and Cool Grinding.



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Types to fit any machine used for tapping or reaming.

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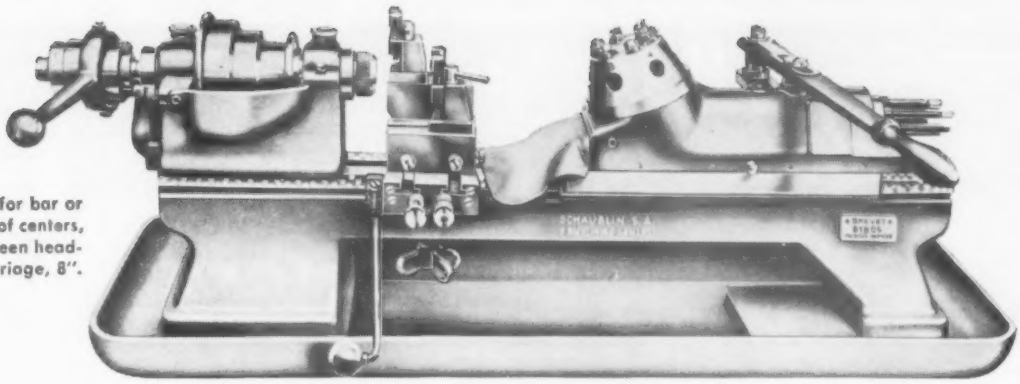

SV 70 Turret Lathe for bar or chuck work. Height of centers, 2.8". Distance between headstock and turret carriage, 8".

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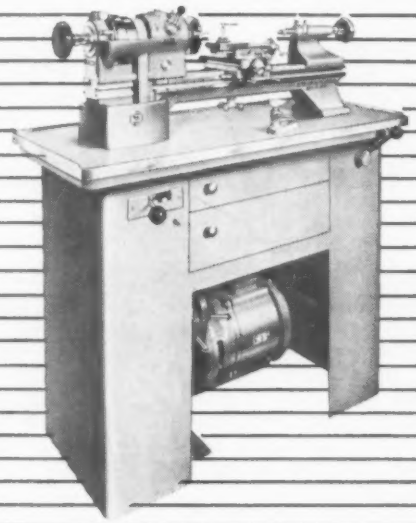
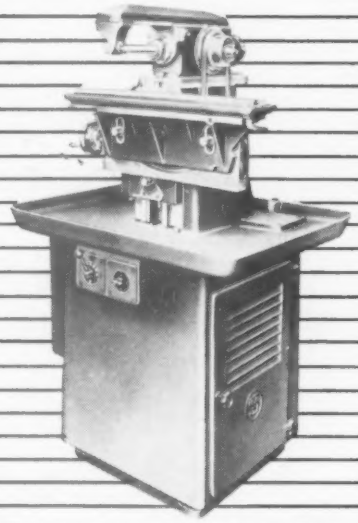
These SV Machines fully warrant your inquiry for complete information. They have contributed greatly toward winning for the Schaublin line a fine reputation for the adaptability and precision that are highly prized by toolmakers. Factory service, interchangeable units and accessories are available from American warehouses. Consult us on your tool-making problems.



SV 102 Toolmakers' Lathe for which great variety of independent and interchangeable units and accessories are available.



SV 12 High-Precision Milling Machine—one of five different types. Table sizes 4-23/32 X 16-1/2" to 10 X 43-5/16".

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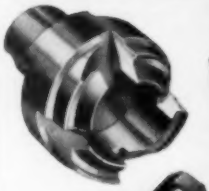
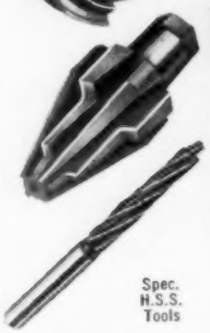
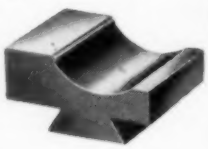
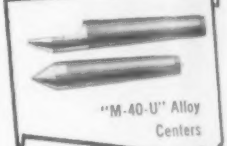



Spec. H.S.S. Tools

Inserted Blade Cutters



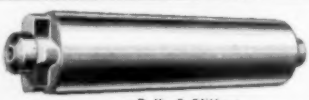
Tool Bits


"M-40-U" Alloy Centers

Tipped Work Rest Blades

Std. H.S.S. Cutters

Railroad Turning Tools


Rolls & Slitters

Ground Cutoff Blades

Gorham TOOL COMPANY

14407 WOODROW WILSON DETROIT 3, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-138-1

Choice of the Leaders

RUTHMAN GUSHER MACHINE TOOL COOLANT PUMPS

The leading manufacturers of metal-cutting equipment install Ruthman Gusher Coolant Pumps on their machines because they know from experience that Gusher Coolant Pumps combine top performance with long trouble-free life.

Follow the leaders—specify Gusher Coolant Pumps on your machines. There's no priming or packing, you get copious coolant flow where you want it, when you want it, and the heavy-duty pre-lubricated ball bearings need no further attention. Write us today.

THE RUTHMAN MACHINERY CO.
1810 Reading Rd. CINCINNATI, OHIO

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Over 85% of the torque wrenches used in industry are

STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch ounces
...inch pounds
...foot pounds
(All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

P.A. STURTEVANT CO.
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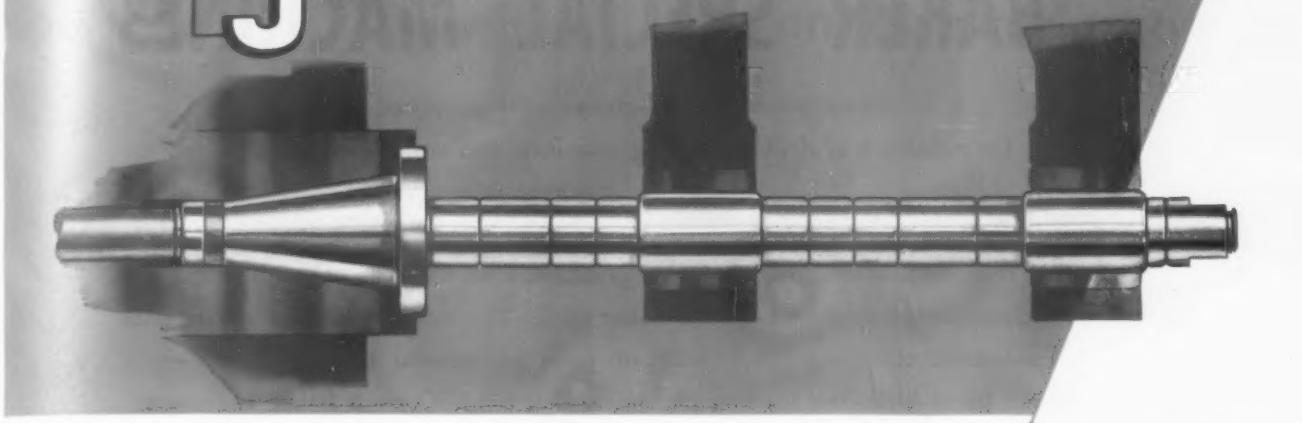
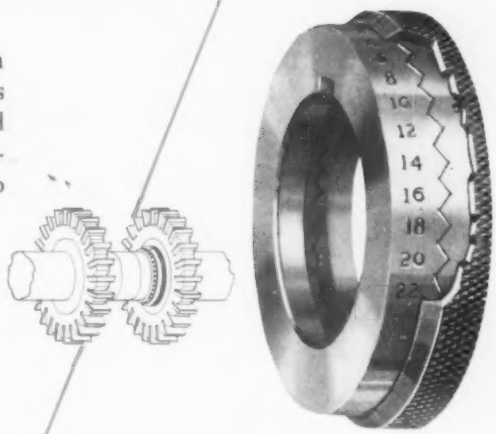
FOR FAST, ACCURATE, LOW-COST
MILLING MACHINE OPERATIONS

Use S-J ARBORS and ADAPTERS



Make heavy or light cuts fast and accurate with S-J rugged precision built Arbors. Arbor and pilot diameters held to plus .0000″, minus .0005″. Arbors filled with spacers and sleeves which have faces ground parallel within .0002″—makes cutters run true and take an even distribution of cutting load. Taper shanks are checked on light gauges to guarantee a perfect fit in spindles and minimize run-out.

Low-cost milling machine operations are assured when using S-J Arbors. Built from forgings, they are tough and withstand the punishment required of today's production. Mass produced, they meet the test of low-cost tooling—quality at low cost that can't be beat.

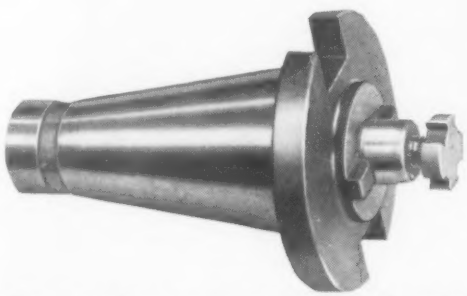


TIME-SAVING S-J ADJUSTABLE SPACING COLLARS

Save valuable time in making accurate adjustments between cutters on gang or straddle milling, and on multiple slotting set-ups.

HIGH PRECISION S-J SOLID SPACING COLLARS

Help assure true-running cutters. Carefully heat treated and faces ground parallel within .0002″.



LARGE SELECTION S-J ADAPTERS

Style "C", Shell End Mill Arbor, shown here, is only one of the various S-J Adapters that enables you to convert spindles for driving a variety of tools, such as: end mills, facing mills, keyway cutters.

Write for New Bulletin No. 2-50 showing complete line of S-J Arbors, Collars and Adapters.

Scully-Jones AND COMPANY

1915 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

R-5275

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

More operations per cycle mean LOWER COST PER PART!

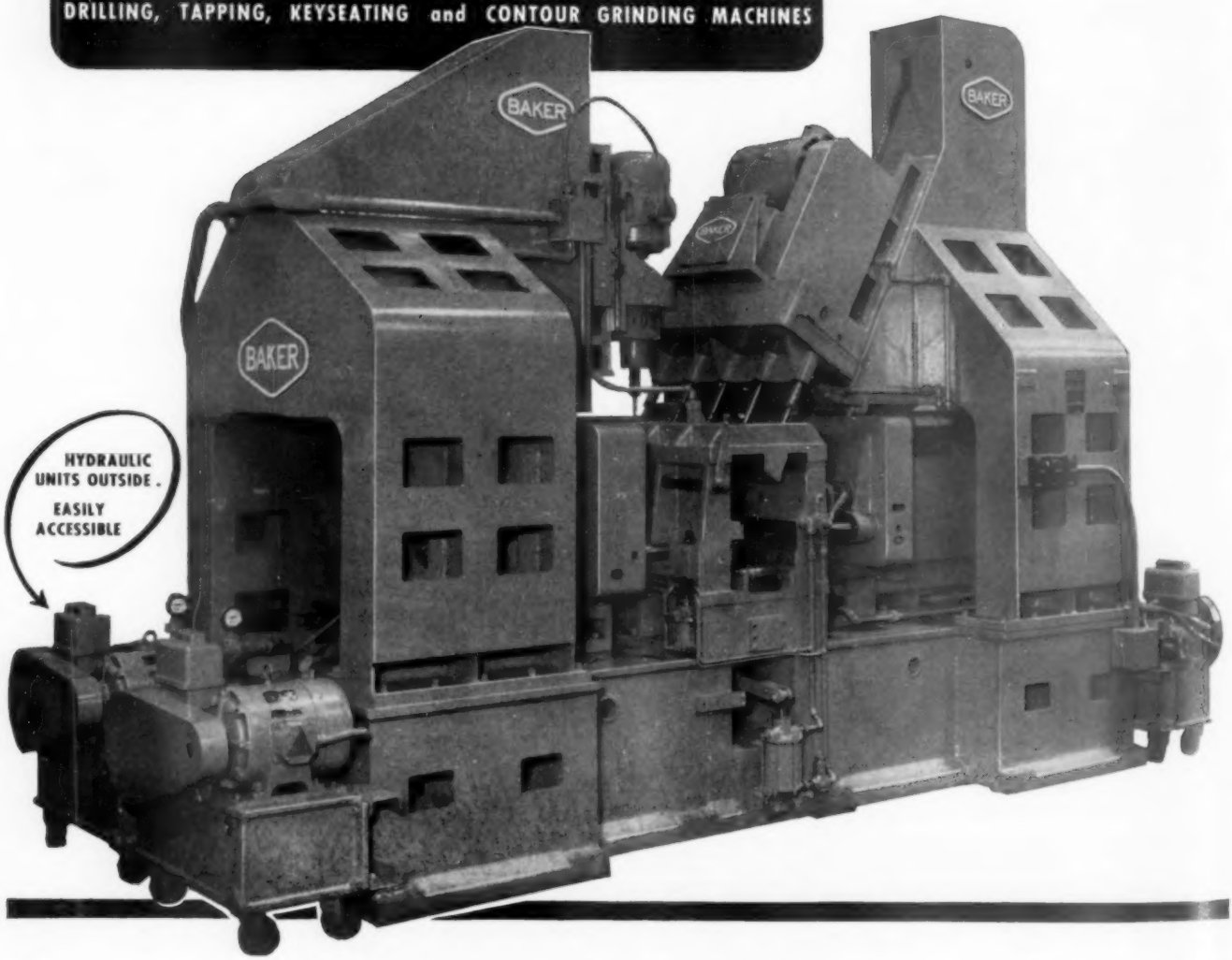
BAKER SPECIAL MACHINES

Baker production machines offer unlimited opportunity for reduction of drilling, boring, reaming, and tapping costs. The new 16 spindle Baker machine illustrated performs 16 individual operations simultaneously on automobile cylinder blocks. Drilling, boring, reaming and countersinking operations are accomplished from vertical, horizontal and angular planes by 4 standard Baker units. The machine is conveyor fed with automatic clamping. Cycle time: 80 parts per hour at 100% efficiency—.75 per piece including loading and unloading time. Consult Baker engineers . . . cut your production costs through increased productivity.

SINCE 1867 . . .

BAKER BROTHERS, INC., Toledo, Ohio

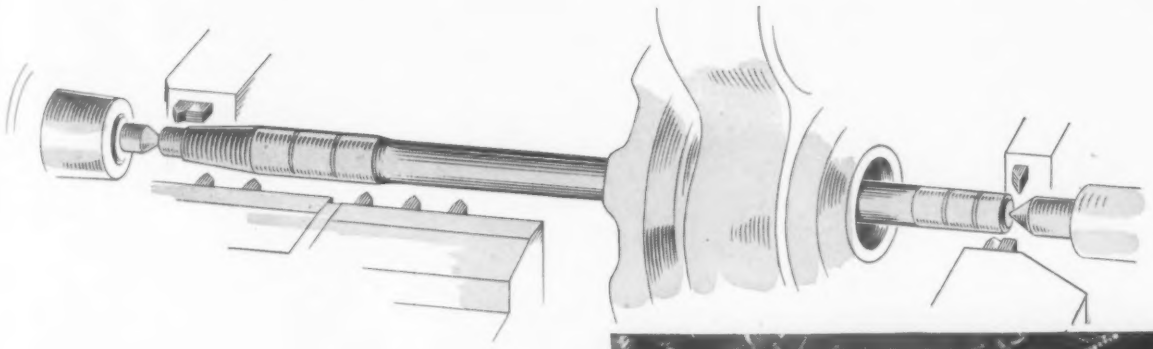
DRILLING, TAPPING, KEYSEATING and CONTOUR GRINDING MACHINES

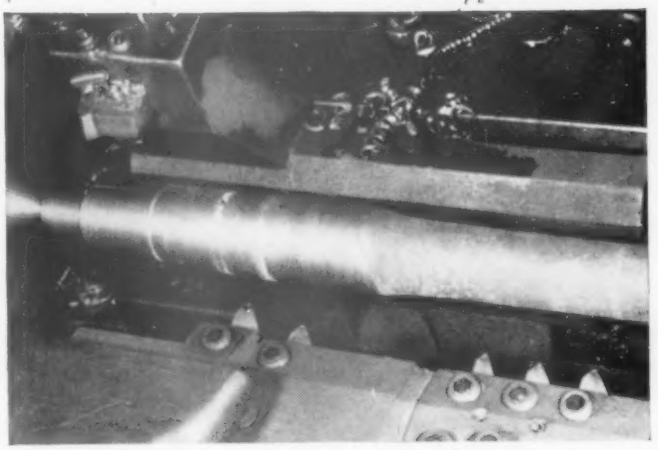


"STELLITE" ALLOY TOOLS

RESIST CHIPPING and WEAR

on this production job





Tool setup for machining rear axle shafts. The HAYNES STELLITE *98M2 tools used in this lathe turn out 200 pieces per grind.*

Machining 200 pieces per grind—when the part is made of an alloy steel with a Brinell hardness of 300 to 325—calls for tools that are unusually tough as well as extremely abrasion-resistant. The tools have to resist spalling and chipping because they are subjected to shock. They have to have exceptional abrasion-resistance because of the hardness of the part being machined.

The part—a rear axle shaft—is long and has a relatively small diameter. The pressure of the tools on its surface during the machining operation causes it to vibrate. It is this vibration that chips and breaks brittle tools. The shaft is machined in a multiple tool setup where the failure of even one tool, either by chipping or from excessive wear, causes a shutdown.

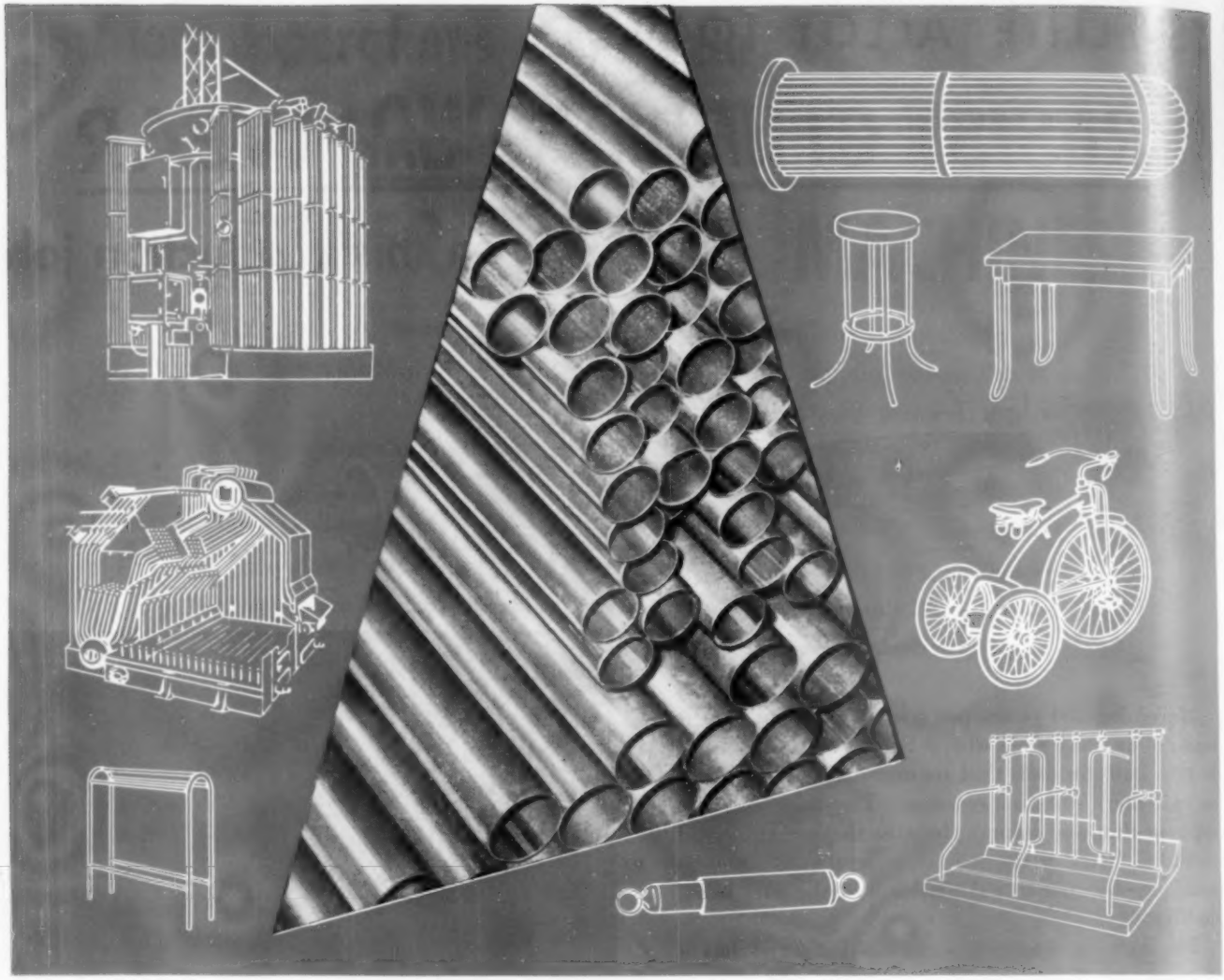
Toughness and abrasion resistance are a big order for any tool—yet the HAYNES STELLITE 98M2 tools being used on this job are meeting all the mass-production requirements of a modern automotive machine shop. These tools take heavy cuts at high speeds and turn out more pieces per grind; they can be used for both rough and finish machining operations. Write to the office nearest you, or to our general sales office in Kokomo, Indiana, for more information and price lists.

Part	Axle Shaft (300 Brinell Steel)
Pieces Per Grind	200
Speed	300 rev. per min.
Feed	.016 in. per rev.
Depth of Cut	1/32 in. to 1/8 in.
Tools	HAYNES STELLITE 98M2 (1/2 in. sq. x 4 in.)

HAYNES
TRADE-MARK
Alloys

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

"Haynes," "Haynes Stellite," and "Stellite" are trade-marks of Union Carbide and Carbon Corporation.



WHY MORE AND MORE TUBING MADE

"The Yoder Way"

GOES INTO THINGS DESIGNED TO STAY

Since Yoder in 1939 first introduced their electric-weld tube mills, high quality tubing at low cost has become available in quantities heretofore undreamed of.

The relatively low first cost of these mills, compactness, simplicity of operation and high production, virtually created a new industry, specializing in making fine tubing and making fine things from tubing.

Thousands of manufacturers of automotive equipment, household appliances, home and business furniture, farm equipment, bicycles, garden tools, boiler tubes, electric conduit, etc., have found in this tubing a ready means of making their products lighter and more attractive in appearance, yet stronger and longer lasting.

As a result, the demand for tubing has increased faster than the supply, so that tube-making "the Yoder way" today, more than ever, offers attractive rewards to private enterprise.

Send for 68-page book of information on the mechanics as well as the economics of tube making. Estimates and recommendations for the asking.

THE YODER COMPANY • 5525 Walworth Avenue, Cleveland 2, Ohio

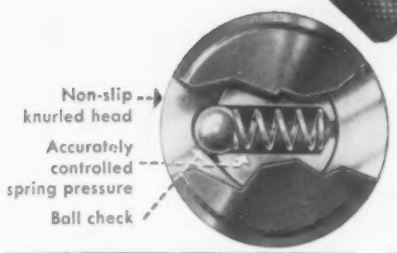
Complete Production Lines

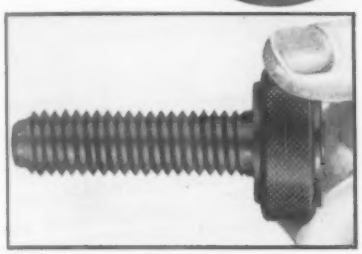
- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

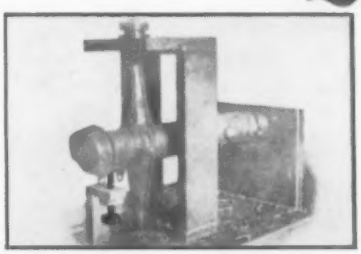
How to Increase PRODUCTION
(And Reduce Parts Rejects)

...Use VLIER TORQUE THUMB SCREWS

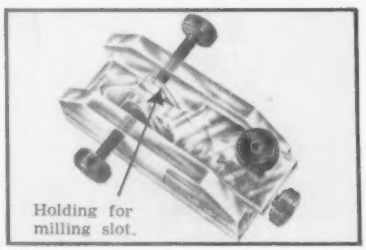




VLIER Torque Thumb Screws are holding tools that *automatically* prevent distortion of work pieces due to over-tightening.



VLIER Torque Thumb Screws firmly support work pieces against drill or mill thrust as shown.



VLIER Torque Thumb Screws quickly provide accurate holding pressures—save time in changing work pieces.

As shown above, VLIER torque thumb screws are simplicity in themselves . . nothing to wear out or cause production stoppages. The spring-controlled ball check *automatically* prevents over-tightening without any attention on the part of the machine operator. *Absolute uniformity of product is guaranteed!* Choose the torque thumb screws you need from the many types available.

REGULAR, Type A — for general use

Item No.	Size	Overall Length	Head Dia. & Width	End pressure in lbs.
T-100	6 x 1¼	1 11/16"	⅞" dia. x 7/16"	10 to 12
T-101	8 x 1¼	1 11/16"	⅞" dia. x 7/16"	10 to 12
T-102	10 x 1¼	1 11/16"	⅞" dia. x 7/16"	10 to 12
T-103	¼ x 1¾	2 3/16"	⅞" dia. x 7/16"	12 to 14
T-104	⅜ x 1¾	2¼"	1⅛" dia. x ½	16 to 18
T-105	⅜ x 3	3½"	1⅛" dia. x ½	16 to 18
T-106	½ x 1¾	2¼"	1⅛" dia. x ½	18 to 20
T-107	½ x 3	3½"	1⅛" dia. x ½	18 to 20
T-108	⅝ x 1¾	2¼"	1⅛" dia. x ½	20 to 22
T-109	⅝ x 3	3½"	1⅛" dia. x ½	20 to 22

INVERTED, Type B — supports work on opposite end

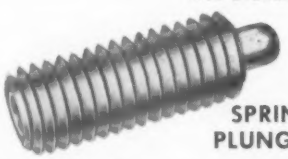
Item No. & Size		End Pressure (lbs.)
T-125	¼ x 1¾	12 to 14
T-126	⅜ x 1¾	16 to 18
T-127	½ x 1¾	18 to 20
T-128	⅝ x 1¾	20 to 22

TEEHEAD, Type C — for use with sliding V-blocks

Item No. & Size		End Pressure (lbs.)
T-150	¼ x 1¾	18 to 20
T-151	⅜ x 1¾	24 to 26
T-152	½ x 1¾	26 to 28

Also available in adjustable type where you set your own holding pressure.

Other VLIER products include:

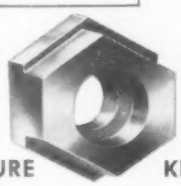


SPRING PLUNGERS

Available in 11 sizes. Used for positioning, or wherever spring tension is desired.

SPRING STOPS

Designed for quickly positioning work pieces and providing 14 or 32 lbs. spring holding tension.



FIXTURE KEYS

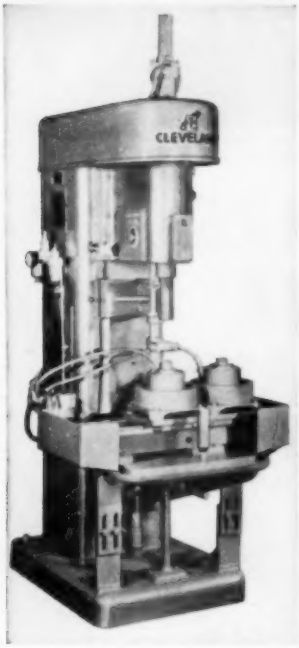
Amazing timesavers. Allow work change-overs with practically no "down time."

MACHINE TOOL SPECIALTIES

Write for catalog or see your local VLIER Distributor for further information.

VLIER MANUFACTURING CO.
4552 Beverly Blvd., Los Angeles 4, Calif.

Cut Your Tapping Costs with
CLEVELAND TAPPERS



On Tapping, Threading, Drilling, Spot-facing, Reaming, and Chamfering operations, the chances are that CLEVELAND engineers can save you money and valuable working time by designing a CLEVELAND Tapping Machine which will not only combine several operations but also tap groups of holes at one stroke of the machine. *Check with CLEVELAND first.*

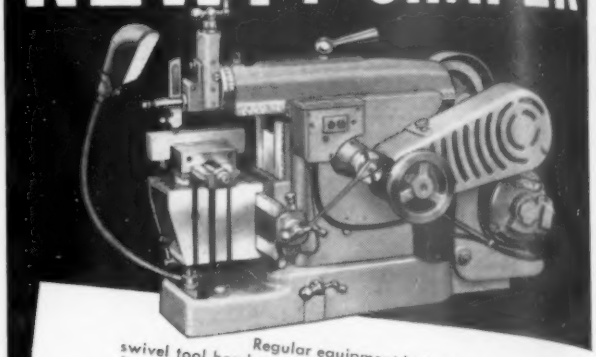
If you would like recommendations on a machine, submit prints, specifications, and sample parts. Write for your copy of the CLEVELAND Production Tapping Guide No. T-4.

This Cleveland Tapping Machine is set up on a munitions job, tapping a 1 5/32", 16-pitch Buttress thread in SAE 4340 steel tubing hardened to 35 to 37 Rockwell.

THE CLEVELAND TAPPING MACHINE CO.
A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC.
CANTON 6, OHIO

USE READER SERVICE CARD; INDICATE A-5-144-1

NEW! SOUTH BEND 7" SHAPER



Regular equipment includes power feeds, swivel tool head graduated 90° right and left, vise, light fixture, switches, drive unit and belt guards, as illustrated.

This NEW 7" Precision Bench Shaper is an accurate and rugged machine tool. It is economical to operate and is readily adaptable to a wide variety of toolroom, production and maintenance work. Designed for exacting industrial use, this 7" shaper is ideal for machining small parts in any type of shop.

For information on 7" Bench Shapers; 14" Drill Presses; Lathes with 9", 10", 13", 14½", 16", and 16-24" swings; 1/2" and 1" collet Turret Lathes; write to—

SOUTH BEND LATHE
SOUTH BEND, INDIANA
BUILDING BETTER TOOLS SINCE 1906

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5107 Pacific Blvd., Los Angeles 11, Calif.
SPECIALIZING ONLY IN DRILL BUSHINGS

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ALL OVER THE U. S. A.

Columbia warehouses and representatives are in principal cities.

Trained and capable men are ready to help with the many new tool steel problems.

COLUMBIA TOOL STEEL COMPANY
ARTHUR T. CLARAGE, PRESIDENT
MAIN OFFICE AND WORKS
520 EAST 14TH. STREET • CHICAGO HEIGHTS, ILL.

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BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., U.S.A.

Branch Offices and Warehouses — Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All principal U. S. Cities, South American and European Countries
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Top Performance Consistently Duplicated

This TUTHILL
Automatic Reversing Pump helps answer design problems

If your problem involves driving the pump from a reversing shaft, Tuthill Model R is a practical answer. This automatic reversing pump delivers from the same port regardless of direction of shaft rotation. Its flexibility of performance makes it ideal for lubrication and coolant service, particularly wherever the ultimate direction of shaft rotation is not known. Capacities from 1 to 200 g.p.m. and pressures up to 100 p.s.i.

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TUTHILL PUMP COMPANY
939 East 95th Street, Chicago 19, Illinois

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AMES HAS THE BETTER ANSWER to your Long Range Problem

MODEL NO. 2822

Ames Long Range Dial Indicators are doing a better job on those difficult quality control jobs which require long range close tolerance inspection. Problems such as those involving measurement of slide motions, cam travel, or checking the depth of recesses and penetrations are easily and accurately solved with Ames Long Range Dial Indicators. Models are available having ranges from ½" to 12". Some dials graduated in .001", some in .0005". Other models graduated in .0001". Write for detailed information or send your problem to Ames Engineering Department. There is an Ames Gauge or Indicator to solve practically any measuring problem controlling quality of process or product.

Representatives in principal cities. B. C. AMES CO. *30 Ames Street Waltham 54, Mass.*
Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

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Severance CARBO-MILLS GROUND-from-the-Solid

The all-purpose CARBIDE mill at LOW cost. Use them same as you would High Speed mills or Rotary Files — Same machines — Same speeds (or higher). No more, time consuming, "kid-glove" care. Just chuck them up in your regular equipment and watch these RUGGED CARBO-MILLS go to work!

SOLID CARBIDE CUTTING HEADS

CARBO-MILLS ASK NO SPECIAL FAVORS

3/32" SHANKS
7 Standard Numbers, featuring REAL cutting teeth to remove stock faster over long periods of use—as well after regrinding as when new.

CARBO-MILLS by the ORIGINATOR of Ground-from-the-Solid Mills

1/8" SHANKS
12 STANDARD NUMBERS
THE POPULAR WORK BENCH SET

NO PROBLEM OF TOOTH CHIPPING OR BRAZE-FAILURE

CARBO-MILLS PREFERRED BY OPERATORS!

1/4" SHANKS

20 STANDARD NUMBERS

20 Standard Numbers (only 9 illustrated) cover the widest possible range of uses. Don't continue losing valuable time and money; replace your less efficient Rotary Files with these longer lasting, faster cutting, stamina possessing, CARBO-MILLS at the earliest possible moment!

LAST UP TO 75 TIMES LONGER THAN ROTARY FILES OF HIGH SPEED

REGRINDING — Due to CARBO-MILLS being made of Solid Carbide repeated savings are made possible through successive regrinds.

INVESTIGATE NOW!

FOR COMPLETE INFORMATION AND PRICES SEND FOR BULLETIN CM.

DIE MAKERS! ASK FOR THIS SET

Furnished to you in a sturdy wooden case, Di-cor Set No. 40 is a set of 8, ¼" shank CARBIDE mills designed and instituted specifically for you, the Tool and Die Maker. Specially selected shapes — Special tooth patterns and cuts for all types of precision Tool and Die work. You will ply your skills easier and faster than ever before with these personal finishing mills. These CARBIDE mills need absolutely no coddling and will win their way to the the most favored spot on your Work-Bench! Send for complete information and prices today! Ask for Leaflet No. 645

- - - GROUND-from-the-Solid - - -

SEVERANCE TOOL INDUSTRIES, INC.
728 Iowa Ave. Saginaw, Michigan
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YOUR "SPECIAL BUSHINGS" MAY BE OUR REGULAR STOCK ITEMS!

Ready for Immediate Delivery

TWO complete bushing standards, the A.S.A. Standard plus our own Acme Standard, provides a much wider selection, enabling you to obtain bushings from stock that often would require special manufacture. Results in faster delivery, lower cost. Write for catalog.

Accurate Interchangeable Concentric

Acme Industrial Company
Makers of Hardened and Ground Precision Parts
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THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS

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Jones & Lamson

Ground Thread Chasers for 25 years!

FIRST and FINEST...

All models of Jones & Lamson RADIAL TYPE Automatic Opening Threading Dies are equipped with GROUND THREAD CHASERS. They are the ideal investment for general threading work involving relatively small lots and diversified pitches. They will lower your tooling inventory too, because standard chaser sets are immediately available from factory stock.

- Ground Thread Chasers for ALL Models
- Class III Accuracy Guaranteed

RADIAL DIE HEADS

VERSATILITY—Will cut right or left hand threads, coarse or fine pitch. Capacities from No. 8 to 4¼".

STOCK REMOVAL—Unbeatable for coarse pitch, heavy duty threading such as Modified Square, 29° Acme, Worm or other threads.

STRENGTH—Every part is of solid steel, hardened and precision ground — no built-up sections.

FLOAT—All models are built with both eccentric and longitudinal float.

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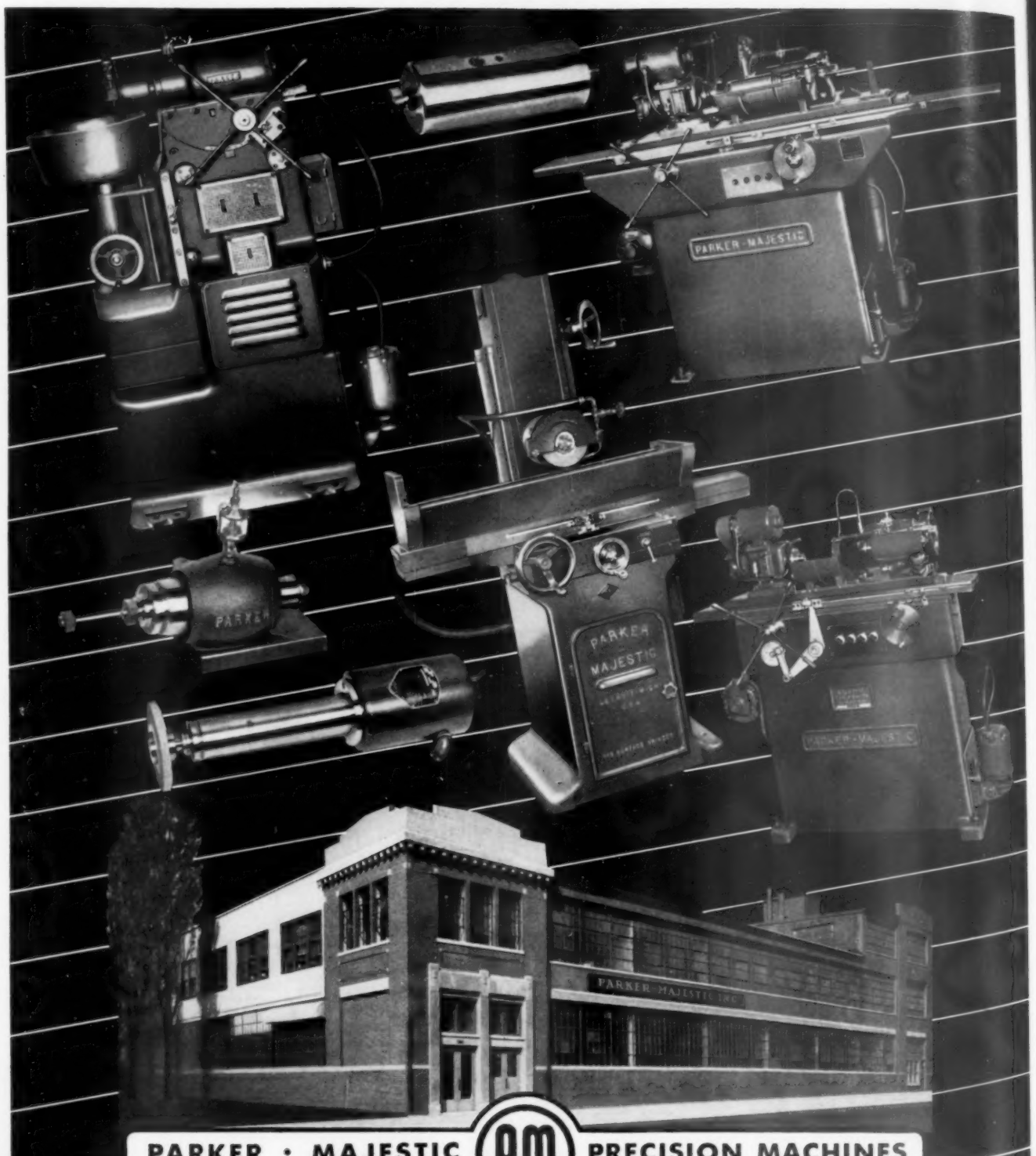
ROUGH & FINISH LEVER—Heavy roughing cuts, followed by light, accurate finishing cuts can be taken with the same set of chasers.

Jones & Lamson

JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U. S. A.

Manufacturer of: Universal Turret Lathes · Fay Automatic Lathes · Automatic Double-End Milling and Centering Machines · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies and Chasers · Ground Thread Flat Rolling Dies



PARKER • MAJESTIC PM PRECISION MACHINES

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PARKER-MAJESTIC, INC.

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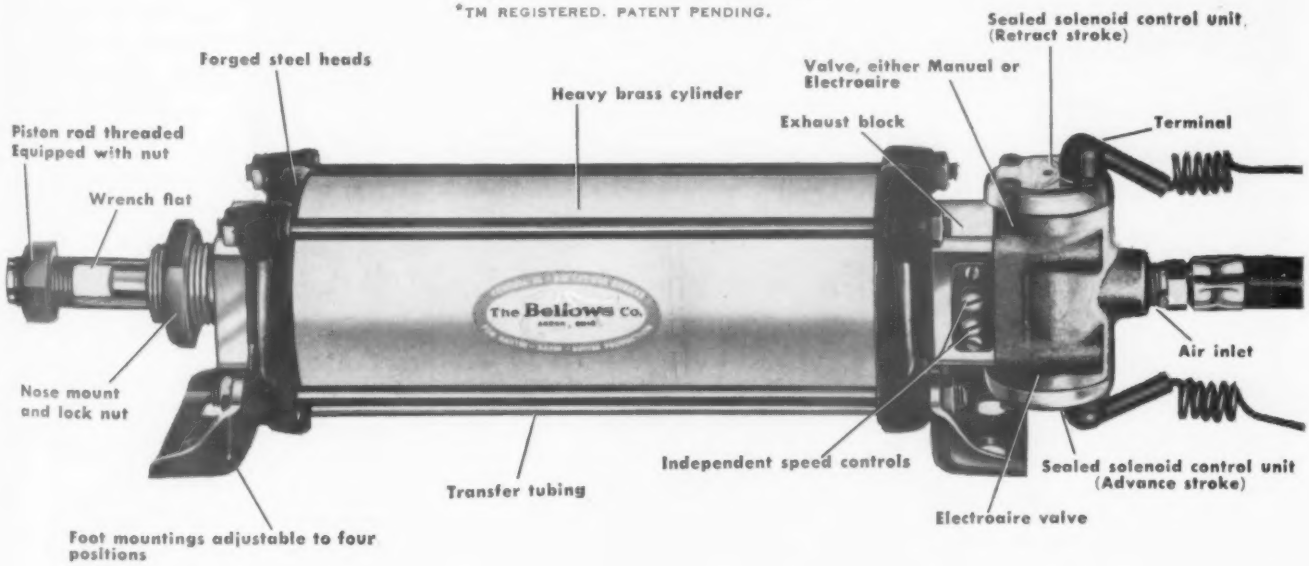

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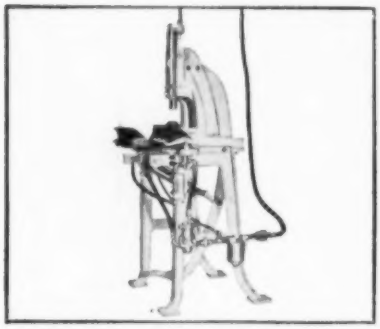

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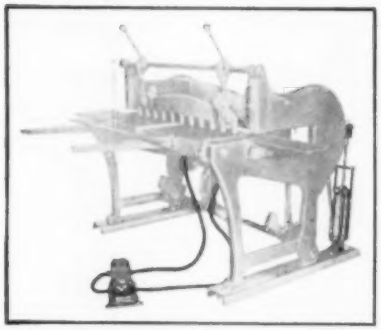

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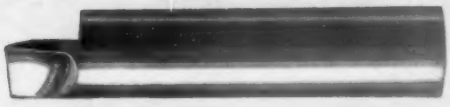

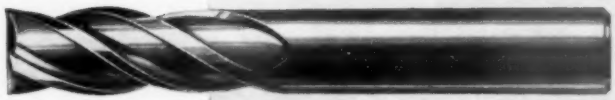

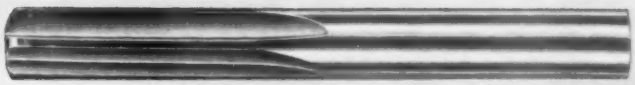

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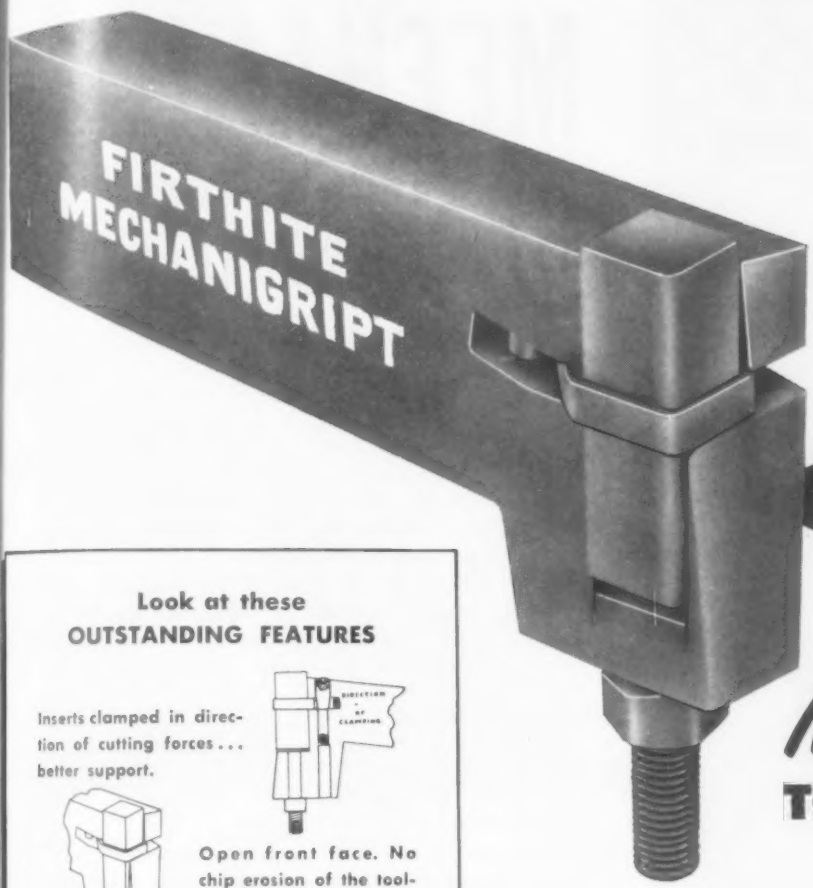

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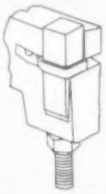

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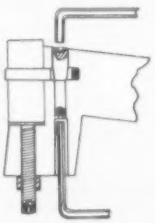

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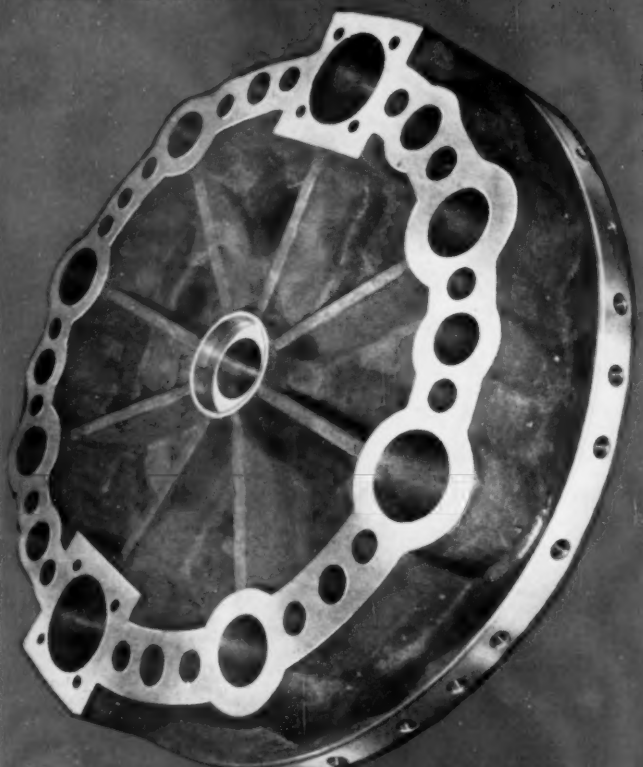

Upper Turret Casting for Type R-7 Wiedemann Turret Punch Press. The outside Diameter is 52". The Weight is 2900 lbs. Because the Turrets in Type R-7 Wiedemann Presses must have Great Strength, Fine Machinability and be Non-Porous, MEEHANITE CASTINGS are used for these parts.

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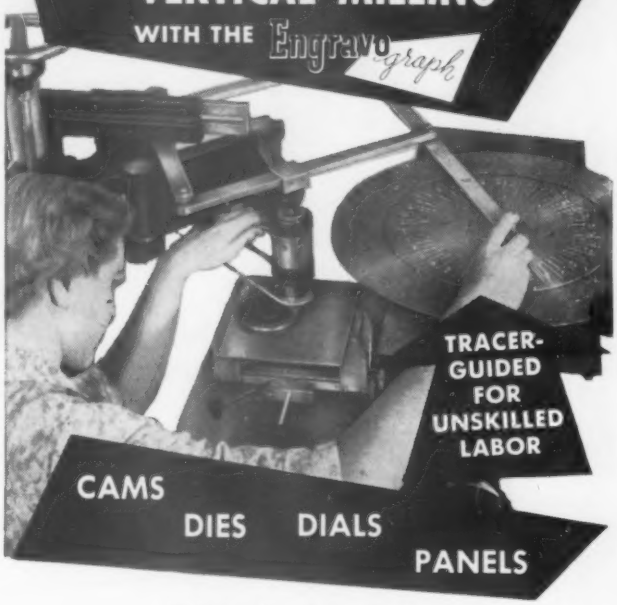

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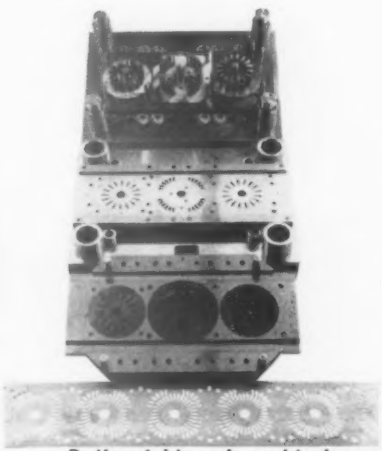

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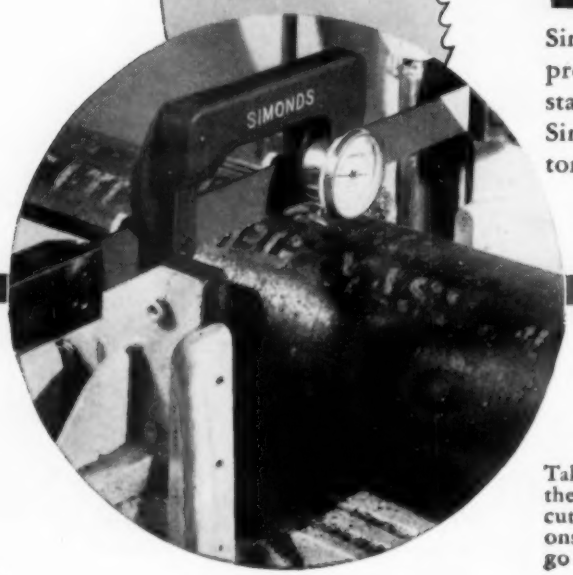

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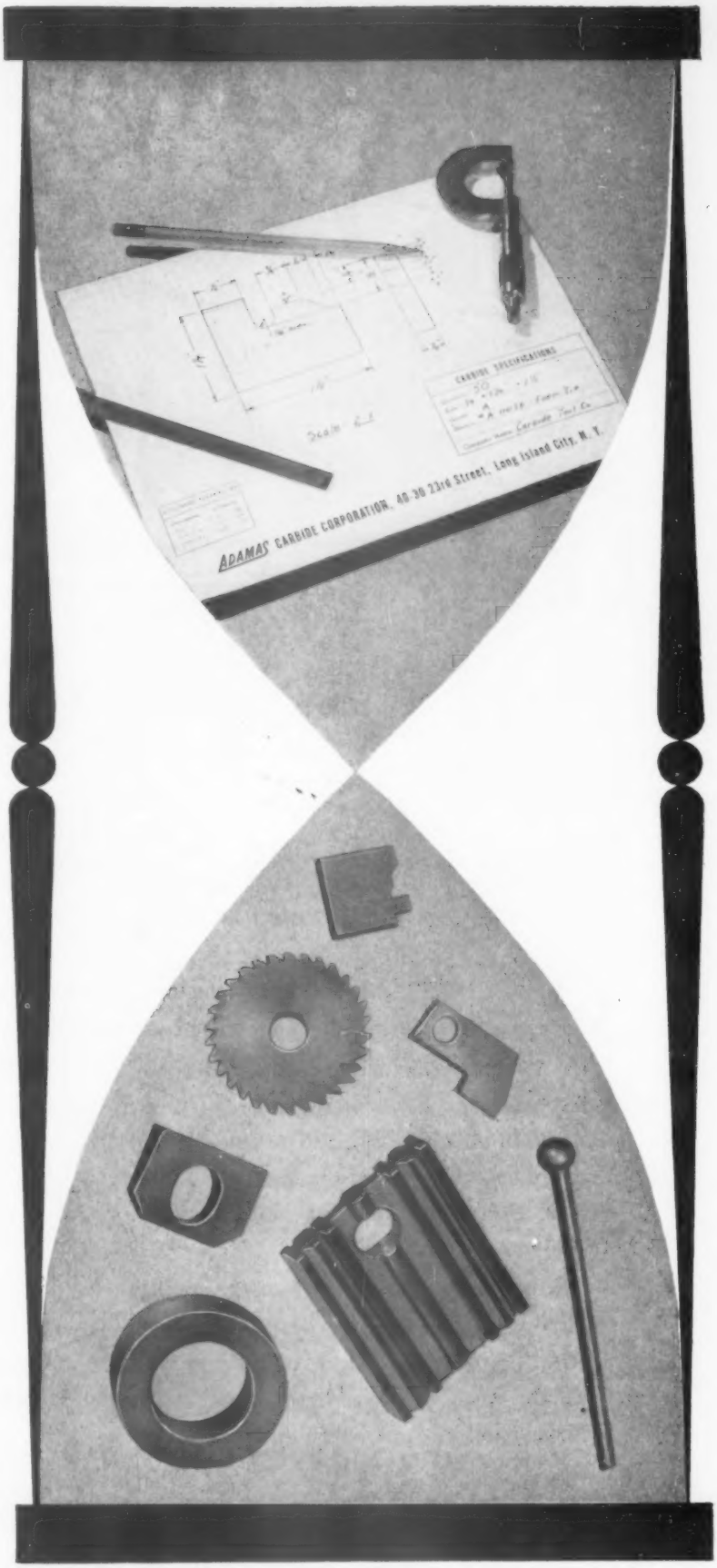

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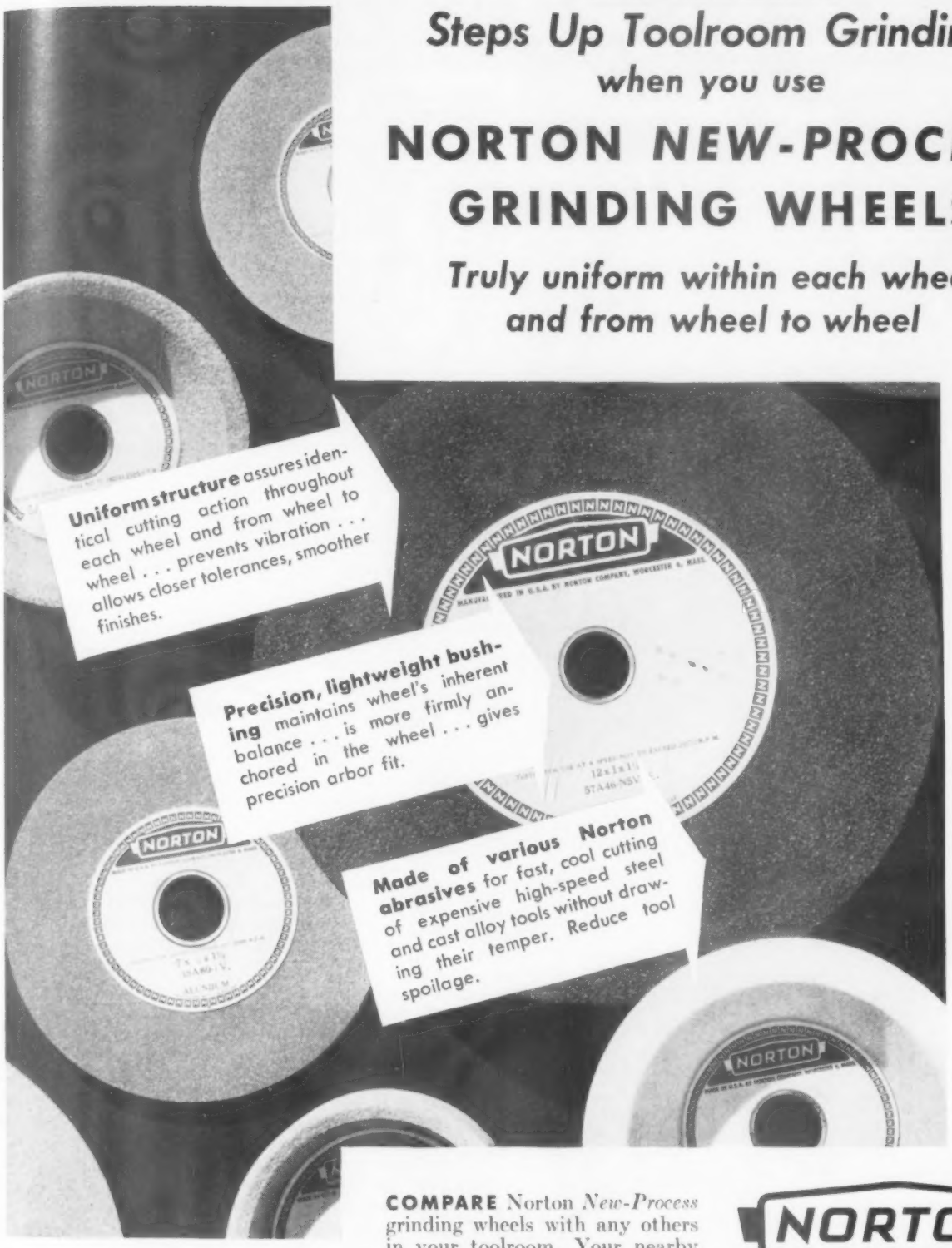
Truly uniform within each wheel and from wheel to wheel


Uniform structure assures identical cutting action throughout each wheel and from wheel to wheel . . . prevents vibration . . . allows closer tolerances, smoother finishes.
Precision, lightweight bushing maintains wheel's inherent balance . . . is more firmly anchored in the wheel . . . gives precision arbor fit.
Made of various Norton abrasives for fast, cool cutting of expensive high-speed steel and cast alloy tools without drawing their temper. Reduce tool spoilage.
NORTON

YOUR NORTON DISTRIBUTOR NOW HAS THEM in sizes and shapes up to 12" diameter for any toolroom grinding job. **ASK FOR THEM.**

COMPARE Norton *New-Process* grinding wheels with any others in your toolroom. Your nearby Norton distributor or representative will help you select the ones that will step up your production and lower your costs.

NORTON COMPANY
WORCESTER 6, MASS.
Warehouses in 5 cities.
Distributors in all principal cities.

NORTON
ABRASIVES

Making better products to make other products better

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-161

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MAY, 1951

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400 Madison Ave.
Phone: Plaza 9-4018
New York 17, New York

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10700 Puritan Avenue
Phone: University 4-7300
Detroit 21, Michigan

WESTERN
Stanley F. Girard
540 N. Michigan Ave.
Phone: Michigan 2-4465
Chicago 11, Illinois

PACIFIC COAST
W. R. McIntyre
423 First Trust Bldg.
Phone: Ryan 1-6981
Pasadena 1, California

quick test screens out noisy transmission gears **before assembly**

A quick test on this new Red Ring Gear Sound Tester, equipped for air clamping, tells you immediately whether or not you have any noisy gears which will need additional processing before they are assembled into automatic transmissions.

The gear being tested is slipped onto the upper arbor and its pinion onto the arbor below, with a C-washer following each. Touching the air control lever locks both in place for the sound test which is run forward and reverse at various speeds and loading. Both gear and pinion are demounted just as easily after the test.

The gears are clamped by a predetermined spring pressure for positive safety under test. The compressed air is used to release the spring pressure for quick loading and unloading.

WRITE FOR SPECIFIC DATA AND PRICES.

5601

SPUR AND HELICAL
GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH AND MACHINE CO.

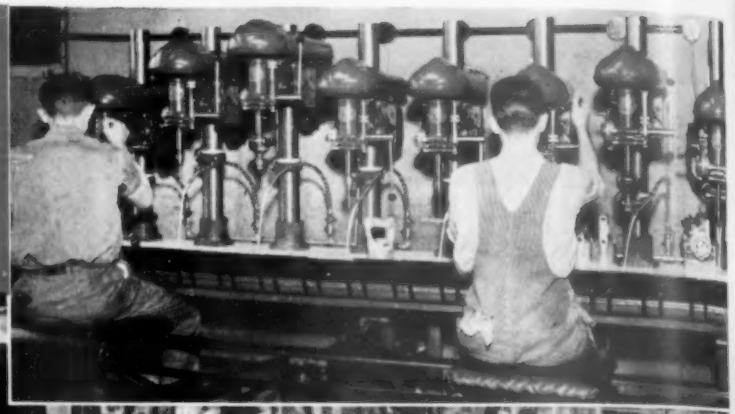
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-163

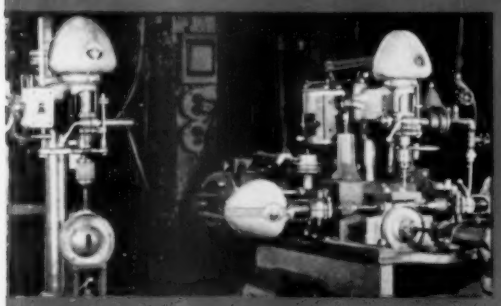
Right: To make it easier for the operators of a long-table, multiple-spindle drill press to go from one work station to another, Albertson and Company, Sioux City, Iowa, devised a roller seat. As the man at the left completes his operation, he passes the work to the right where the other begins his job. The operators are able to travel the length of the table with a minimum of fatigue.

Below: More than 30 spindles comprise this 70'-long set-up of Procter and Schwartz, Inc., Philadelphia, Pa. By similarly putting multiple drill heads in a row, many manufacturers chart a work-piece at one end of a machine and complete the cycle of operations by the time the piece reaches the other end. This saves the cost of handling and storage between operations.



Fit the machine to the drilling job

– instead of making the job fit the machine



Time-Saving Idea! Above is a time-saving installation at The Deming Co., Salem, Ohio.

At the right is a special-purpose unit made up of three standard Delta 14" drill-press heads — two mounted horizontally and one vertically. All three drill holes in a casting at once, automatically.

While the machine is drilling, the operator takes the casting which has been drilled already and taps holes with the single-spindle Delta Drill Press at the left. Thus, he makes use of what is otherwise idle waiting time.

DELTA—the world's most complete line of light machine tools

✓ FIRST IN SELECTION!
✓ FIRST IN QUALITY!
✓ FIRST IN VALUE!

You CAN with Delta® Multiple-Spindle Drill Presses

You can have any number of spindles on sectional tables joined together — in batteries a block long, if that's what the job calls for. You can have either 14" or 17" heads — or both — spaced the way you want them. Sections have a 1½" trough. End sections are tapped for a drain.

Delta-Milwaukee Multiple-Spindle Drill Presses are furnished also in 2- and 4-spindle models with one-piece tables. Multiple-spindle models are available in ½" and ¾" capacities in cast iron.

Take advantage of Delta quality, economy, accuracy, and flexibility, in planning your special drilling equipment. Delta's engineering service is always ready to help. Send for details.

Sold only through authorized dealers — available on easy time payments. Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

DELTA POWER TOOL DIVISION
Rockwell
Manufacturing Company
MILWAUKEE 1, WISCONSIN

Tear out coupon and mail today!

Free...

6 TIMES A YEAR

The Power Tool Journal — packed with detailed job data, fully illustrated — handbook of time- and money-saving shop ideas.

Delta Power Tool Division
ROCKWELL MANUFACTURING COMPANY
6118 E. Vienna Ave., Milwaukee 1, Wisconsin

Send me free — ☐ The Power Tool Journal—6 times a year. ☐ Catalogs and bulletins on complete Delta line.

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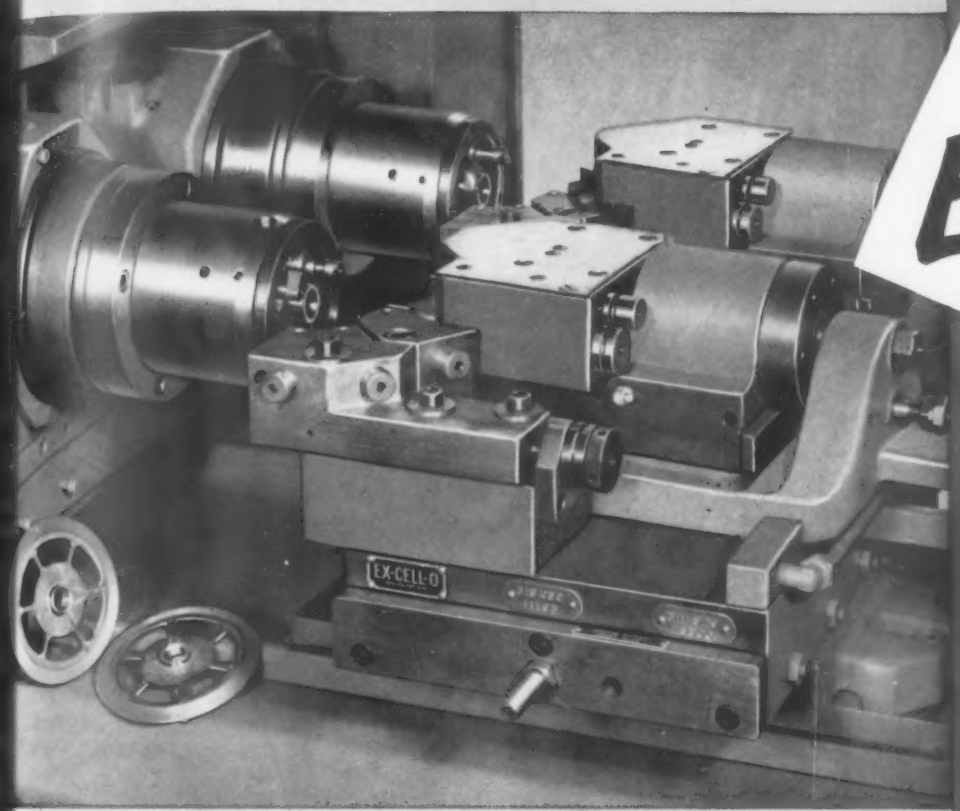
M-5

8 Surfaces Finished In One Cycle . . .

PRECISION MACHINING the EX-CELL-O WAY



LEFT: Ex-Cell-O 2112-A Precision Boring Machine equipped for finishing eight surfaces of die cast aluminum parts. Work pieces in left foreground.

Sectional view of work showing operations in heavy lines.

Flexibility, economy, and high production are all yours with Ex-Cell-O 2112-A Precision Boring Machines. Shown here is a typical use that may suggest a money-saving method for your shop.

Ex-Cell-O engineers designed chucks that clamp die cast aluminum parts by the fins to solve two problems: (1) clamping frail parts without distortion; (2) boring the I.D. and turning the O.D. in one machine cycle.

The operations, performed on two parts simultaneously, include boring inside diameter; chamfering outer edge of bore; turning outside diameter and pilot diameter; facing the small hub and area between outside diameter and pilot diameter; and chamfering outer edges. Net production is 102 per hour.

It may be that a versatile Ex-Cell-O machine of this type is the answer to your machining problem. For full information and specifications, contact your local Ex-Cell-O representative, or write Ex-Cell-O in Detroit today.

Ex-Cell-O Style 2112-A Precision Boring Machine.

XLO

EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

51-4

for PRECISION LOCATING, DRILLING AND REAMING OF HOLES

For the first time, after 5 years of using these Wales designed, engineered and manufactured Drilling Machines in our own plant, they are now introduced to the thousands of manufacturers, who like ourselves, require *precision* locating, drilling and reaming of holes in material of practically any length and up to 36" wide. **There is no other drilling machine or jig borer like it.** It fills a definite need.

Accuracy is the primary consideration in building this exclusive, specially designed and ruggedly constructed Wales Drilling Machine which combines simplicity of operation, easier locating and faster production.

Conveniently located built-in 1/32" scales and dial-type gages calibrated in ten thousandths of an in used in conjunction with precision end measures, a rately locate the drill head and slide rail.

Have the complete story of this Wales Drilling chine at your finger-tips by writing for the NEW fu illustrated, functionally-colored Catalog D M *today*

WALES-STRIPPIT CORPORATIO

GEORGE F. WALES, *Chairman*

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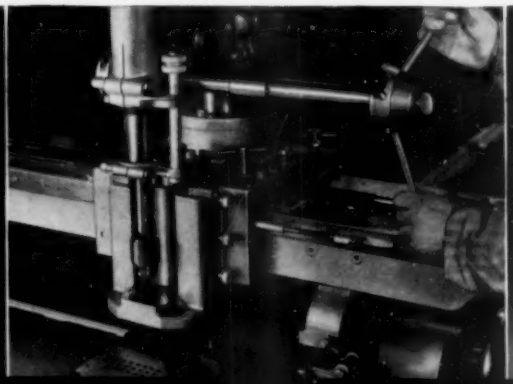
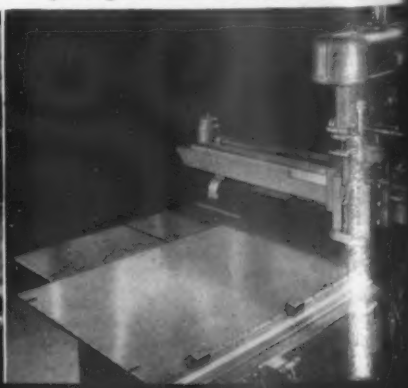
(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTA

Specialists in Punching and Notching Equipme

OCATING...Holes are located by placing end measures n V-grooves on bridge and slide rail. Two speed gearing on oth front-to-back and right-to-left settings provide rapid averse for rough positioning and slow speed for "zeroing ". Air locking clamps are provided for rigid positioning n both horizontal and longitudinal planes.

DRILLING...Showing typical small template being drilled with drill head assembly and slide rail locked in position by air clamps.

REAMING...Showing hole in large template by simply interchanging the drill and bushing ponding size reamer and reamer bushing.